M E M O R A N D U M

To: Lynda Mifsud (METRO)

From: David Ernst (KM Chng Environmental Inc.)

Date: 26 June 2000

Subject: Park and Ride SIP Commitments - Emissions Analysis Results

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KM Chng Environmental Inc. (or KM Chng) has estimated the emissions reductions due to construction or expansion of ten park-and-ride facilities that METRO has designated as 1999 SIP commitments. The attached Table 1 summarizes the emissions results, and shows that the estimated total emission reductions are 0.076 tons per day of nitrogen oxides (NOx) and 0.032 tons per day of volatile organic compounds (VOC). The summary and the analyses for each park & ride are attached.

Park-and-ride facilities are primarily commuter services. When a park-and-ride lot begins operation, commuters who formerly drove all the way to their workplace will now make a shorter drive (the access trip) to the park-and-ride lot, and then board a METRO bus for the longer (usually freeway or line-haul) segment of the work trip to downtown. This decrease in personal vehicle-miles traveled (VMT) will decrease the emissions from personal vehicles. However, this emission reduction is less than proportionate to the mileage reduction, because the work trip typically starts with the engine cold, and emission rates are higher with a cold start than in warmed-up operation. These higher emission rates for a cold start apply to all such trips and are not reduced when the trip is shortened. Emissions are also added by the buses that serve the park-and-ride lot for the line-haul segment of the work trip.

For each of the ten facilities, KM Chng compiled data supplied by METRO on the average distances and speeds for the work trip before facility implementation, the access trip with the facility, and the bus line-haul trip segment with the facility. Emission factors in grams per VMT were calculated for the year 1999 using the U.S. Environmental Protection Agency (EPA) MOBILE5a_h model with inputs provided by the Houston-Galveston Area Council (H-GAC). Emission rates for personal commuting vehicles (autos and light trucks) were calculated based on the regional vehicle mix provided by H-GAC, but excluding the commercial and heavy vehicle types. The percentage of VMT driven in cold start mode was estimated for personal vehicles based on trip distance and speed, and the emission factors were calculated accordingly.

METRO provided data on the bus VMT that was attributable to each facility. Some of the park-and-ride lots are associated with existing transit centers that were already served by METRO bus routes. Buses also already served those existing park-and-ride lots that were expanded. METRO evaluated the bus services to determine which routes were created, diverted, or had service increased as a result of the new or expanded park-and-ride facilities. Only the new bus VMT, i.e., bus mileage that

would not have occurred in the absence of the new or expanded facilities, was included in the emissions analysis. Buses were assigned emission rates for the MOBILE5a_h Heavy Duty Diesel Vehicle class. For each segment of the work trip, emissions were calculated as the product of VMT and the emission factor. The emissions for all trip segments were summed for conditions with and without the park-and-ride lot, and the difference between the two sums indicates the emissions change due to the facility.

The differences in emissions for individual park-and-ride facilities tend to be small, and can be affected by small changes in trip distances, cold start percentages, bus VMT, and speeds. As shown in Table 1, the total emission reductions of 0.076 tons per day of NOx and 0.032 tons per day of VOC include three facilities where emission increases were estimated. These facilities are Hillcroft Transit Center, Monroe Park-and-Ride, and Mission Bend Park-and-Ride. At Hillcroft Transit Center, the difference in distance for personal vehicles between the full work trip and the access trip is small, but the access trip speed is much lower than the full work trip speed. The lower speed is associated with a higher VOC emission factor, which offsets the shorter distance, resulting in slightly higher VOC emissions from personal vehicles with the facility. At Monroe Park-and-Ride, the added bus VMT is relatively high, which offsets the emission reductions from personal vehicles for both NOx and VOC. At Mission Bend Park-and-Ride, the added bus VMT is modest, but the bus speeds are relatively low, leading to higher NOx emissions from buses, and these emissions barely offset the decrease in NOx emissions from personal vehicles. However, as noted above, the net effects of all ten facilities are decreases in both NOx and VOC emissions. If only the seven facilities with emission reductions in both NOx and VOC are considered, the net total emission reductions would be 0.092 tons per day of NOx and 0.035 tons per day of VOC.

Table 1

Emissions Summary for METRO Park & Ride Facilities
For 1999 SIP Commitments

METRO Park & Ride Facility	**Net Emissions Change* (tons/day)**	
	VOC	**NOx**
Tidwell Transit Center	-0.00003	-0.0002
Mesa Transit Center	-0.0003	-0.0003
Hillcroft Transit Center	0.0009	-0.0041
Monroe Park & Ride	0.0029	0.0198
Mission Bend Park & Ride	-0.0006	0.0002
West Bellfort Park & Ride	-0.0102	-0.0278

Kingwood Park & Ride – Modification	-0.0001	-0.0003
Northwest Station - Second Expansion	-0.0107	-0.0351
Addicks Park & Ride - Second Expansion Phase 1	-0.0091	-0.0135
Bay Area Boulevard Park & Pool	-0.0050	-0.0149
Total emissions change for all facilities	-0.0322	-0.0763

- Negative number indicates emissions decrease.

Houston METRO - Transit/Transportation Control Measures
Air Quality Analyses
Analysis of SIP Commitments for PARK & RIDE FACILITIES

Rev. 6/23/00
prkride8.xls

PARK & RIDE FACILITIES SUMMARY

Park & Ride Facility	Net Emissions Change (tons/day) VOC	NOx
Tidwell Transit Center	-0.00003	-0.0002
Mesa Transit Center	-0.0003	-0.0003
Hillcroft Transit Center	0.0009	-0.0041
Monroe Park & Ride	0.0029	0.0198
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Kingwood Park & Ride - Modification	-0.0001	-0.0003
Northwest Station - Second Expansion	-0.0107	-0.0351
Addicks Park & Ride - Second Expansion Phase 1	-0.0091	-0.0135
Bay Area Blvd. Park & Pool	-0.0050	-0.0149
Total all facilities (negative number indicates emissions decrease	-0.0322	-0.0763

Site: Tidwell Transit Center

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity	vehicles		-	786	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity		-	3.1%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day		24	24	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	miles 1-way		6	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph		45	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes		8.0	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%		100.0%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.
Emission factors	g/veh-mi	VOC	1.241	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)

		NOx	1.802	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip	g/veh, 1-way	VOC	7.446	6.932	(Emission factor) * (trip distance)
		NOx	10.812	6.160	
Total vehicle emissions	g/day, all round trips	VOC	357	333	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		NOx	519	296	
	tons/day, all round trips	VOC	0.0004	0.0004	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		NOx	0.0006	0.0003	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	4,45,54, 57,83	Daily bus-miles		0	No added bus service due to park & ride facility, per METRO (*Park & Ride SIP Commitment Analysis* , 5/2/00). Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions	tons/day	VOC		0.0000	Sum of all Bus Routes
		NOx		0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.00039	0.00037	From II. B above
		NOx	0.0006	0.0003	
Bus emissions	tons/day	VOC	0.00000	0.00000	From II. C above
		NOx	0.0000	0.0000	
Total emissions, all vehicles	tons/day	VOC	0.00039	0.00037	Sum of personal vehicle + bus
		NOx	0.0006	0.0003	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.00003	Difference between facility and no-action case.
		NOx	N.A.	-0.0002	Negative number = emissions decrease.

Site: Mesa Transit Center

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity	vehicles		-	100	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity		-	90.0%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day		90	90	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	miles 1-way		5	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph		25	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes		12.0	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%		70.1%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.
Emission factors	g/veh-mi	VOC	1.667	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)

		NOx	1.575	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip	g/veh,	VOC	8.33	6.93	(Emission factor) * (trip distance)
	1-way	NOx	7.87	6.16	
Total vehicle emissions	g/day,	VOC	1,500	1,248	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
	all round trips	NOx	1,417	1,109	
	tons/day,	VOC	0.0017	0.0014	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
	all round trips	NOx	0.0016	0.0012	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	-	Daily bus-miles		0	No added bus service due to park & ride facility, per METRO (*Park & Ride SIP Commitment Analysis* , 5/2/00). Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions	tons/day	VOC		0.0000	Sum of all Bus Routes
		NOx		0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0017	0.0014	From II. B above
		NOx	0.0016	0.0012	
Bus emissions	tons/day	VOC	0.0000	0.0000	From II. C above
		NOx	0.0000	0.0000	
Total emissions, all vehicles	tons/day	VOC	0.0017	0.0014	Sum of personal vehicle + bus
		NOx	0.0016	0.0012	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0003	Difference between facility and no-action case.
		NOx	N.A.	-0.0003	Negative number = emissions decrease.

Site: Hillcroft Transit Center

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume				
Lot capacity	vehicles	-	880	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity	-	45.4%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day	400	400	Capacity * utilization rate
B. Personal Vehicle Trip Emissions				
Average distance	miles 1-way	5.28	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph	55	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes	5.8	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%	100.0%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.

Emission factors		g/veh-mi	VOC	1.172	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
			NOx	2.273	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip		g/veh,	VOC	6.19	6.93	(Emission factor) * (trip distance)
		1-way	NOx	12.00	6.16	
Total vehicle emissions		g/day,	VOC	4,951	5,545	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	9,601	4,928	
		tons/day,	VOC	0.0055	0.0061	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0106	0.0054	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route					
"New" Bus VMT/day	132	Daily bus-miles			16.52	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	163				56.76	Daily Total Miles (not Revenue Miles) by Bus Route
Line-haul ave. speed	132	mph			13	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	163				13	Speed by Bus Route
Bus emission factors	132	g/veh-mi	VOC		2.907	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
			NOx		12.949	Emission Factors by Bus Route
	163	g/veh-mi	VOC		2.907	
			NOx		12.949	
Bus emissions	132	g/day	VOC		48	(Emission factor) * (bus VMT)
			NOx		214	Bus Emissions by Bus Route
	163	g/day	VOC		165	
			NOx		735	
Bus total emissions		tons/day	VOC		0.0002	Sum of all Bus Routes
			NOx		0.0010	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0055	0.0061	From II. B above
		NOx	0.0106	0.0054	
Bus emissions	tons/day	VOC	0.0000	0.0002	From II. C above
		NOx	0.0000	0.0010	
Total emissions, all vehicles	tons/day	VOC	0.0055	0.0063	Sum of personal vehicle + bus
		NOx	0.0106	0.0065	
Net emissions change, all vehicles	tons/day	VOC	N.A.	0.0009	Difference between facility and no-action case.
		NOx	N.A.	-0.0041	Negative number = emissions decrease.

Site: Monroe Park & Ride

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume				
Lot capacity	vehicles	-	874	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity	-	28.4%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day	248	248	Capacity * utilization rate
B. Personal Vehicle Trip Emissions				
Average distance	miles 1-way	10	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph	60	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes	10.0	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%	84.2%	97.4%	(505 sec)/(trip time)

						Cold start % varied based on speed/trip length.
Emission factors		g/veh-mi	VOC	1.213	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
			NOx	2.483	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip		g/veh,	VOC	12.13	6.93	(Emission factor) * (trip distance)
		1-way	NOx	24.83	6.16	
Total vehicle emissions		g/day,	VOC	6,014	3,438	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	12,313	3,055	
		tons/day,	VOC	0.0066	0.0038	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0136	0.0034	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route					
"New" Bus VMT/day	244	Daily bus-miles			485.25	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	247				2,129.73	Daily Total Miles (not Revenue Miles) by Bus Route
Line-haul ave. speed	244	mph			21	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	247				23	Speed by Bus Route
Bus emission factors	244	g/veh-mi	VOC		2.110	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
			NOx		10.699	Emission Factors by Bus Route
	247	g/veh-mi	VOC		1.965	
			NOx		10.346	
Bus emissions	244	g/day	VOC		1,024	(Emission factor) * (bus VMT)
			NOx		5,192	Bus Emissions by Bus Route
	247	g/day	VOC		4,185	
			NOx		22,034	
Bus total emissions		tons/day	VOC		0.0057	Sum of all Bus Routes
			NOx		0.0300	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0066	0.0038	From II. B above
		NOx	0.0136	0.0034	
Bus emissions	tons/day	VOC	0.0000	0.0057	From II. C above
		NOx	0.0000	0.0300	
Total emissions, all vehicles	tons/day	VOC	0.0066	0.0095	Sum of personal vehicle + bus
		NOx	0.0136	0.0333	
Net emissions change, all vehicles	tons/day	VOC	N.A.	0.0029	Difference between facility and no-action case.
		NOx	N.A.	0.0198	Negative number = emissions decrease.

Site: Mission Bend Park & Ride

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume				
Lot capacity	vehicles	-	826	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity	-	12.3%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day	102	102	Capacity * utilization rate
B. Personal Vehicle Trip Emissions				
Average distance	miles 1-way	7.5	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes	18.0	8.6	Distance/speed * (60 min/hr)

% of time in cold start mode	%		46.8%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.
Emission factors	g/veh-mi	VOC	1.445	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
		NOx	1.458	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip	g/veh,	VOC	10.84	6.93	(Emission factor) * (trip distance)
	1-way	NOx	10.93	6.16	
Total vehicle emissions	g/day,	VOC	2,211	1,414	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
	all round trips	NOx	2,230	1,257	
	tons/day,	VOC	0.0024	0.0016	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
	all round trips	NOx	0.0025	0.0014	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	2	Daily bus-miles		58.26	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	25			0	Daily Total Miles (not Revenue Miles) by Bus Route
	132			28.91	Route 25 listed as "NA" in METRO data; zero entered as placeholder.
Line-haul ave. speed	2	mph		11	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	25			12	Speed by Bus Route
	132			16	
Bus emission factors	2	g/veh-mi	VOC	3.177	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
			NOx	13.776	Emission Factors by Bus Route
	25	g/veh-mi	VOC	3.038	
			NOx	13.347	
	132	g/veh-mi	VOC	2.561	
			NOx	11.927	
Bus emissions	2	g/day	VOC	185	(Emission factor) * (bus VMT)

		NOx	803	Bus Emissions by Bus Route
25	g/day	VOC	0	
		NOx	0	
132	g/day	VOC	74	
		NOx	345	
Bus total emissions	tons/day	VOC	0.0003	Sum of all Bus Routes
		NOx	0.0013	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0024	0.0016	From II. B above
		NOx	0.0025	0.0014	
Bus emissions	tons/day	VOC	0.0000	0.0003	From II. C above
		NOx	0.0000	0.0013	
Total emissions, all vehicles	tons/day	VOC	0.0024	0.0018	Sum of personal vehicle + bus
		NOx	0.0025	0.0026	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0006	Difference between facility and no-action case.
		NOx	N.A.	0.0002	Negative number = emissions decrease.

Site: West Bellfort Park & Ride

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume				
Lot capacity	vehicles	-	1,169	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity	-	79.5%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day	929	929	Capacity * utilization rate
B. Personal Vehicle Trip Emissions				
Average distance	miles 1-way	15	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph	55	25	METRO (99P&RDATA.XLS, 11/24/99)

Average trip time	minutes		16.4	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%		51.4%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.
Emission factors	g/veh-mi	VOC	0.908	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
		NOx	1.950	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip	g/veh,	VOC	13.62	6.93	(Emission factor) * (trip distance)
	1-way	NOx	29.24	6.16	
Total vehicle emissions	g/day,	VOC	25,314	12,879	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
	all round trips	NOx	54,334	11,445	
	tons/day,	VOC	0.0279	0.0142	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
	all round trips	NOx	0.0598	0.0126	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route					
"New" Bus VMT/day	265	Daily bus-miles			1,778.98	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Daily Total Miles (not Revenue Miles) by Bus Route
Line-haul ave. speed	8	mph			26	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Speed by Bus Route
Bus emission factors	265	g/veh-mi	VOC		1.777	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
			NOx		9.944	Emission Factors by Bus Route
Bus emissions	265	g/day	VOC		3,161	(Emission factor) * (bus VMT)
			NOx		17,690	Bus Emissions by Bus Route
Bus total emissions		tons/day	VOC		0.0035	Sum of all Bus Routes
			NOx		0.0195	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0279	0.0142	From II. B above
		NOx	0.0598	0.0126	
Bus emissions	tons/day	VOC	0.0000	0.0035	From II. C above
		NOx	0.0000	0.0195	
Total emissions, all vehicles	tons/day	VOC	0.0279	0.0177	Sum of personal vehicle + bus
		NOx	0.0598	0.0321	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0102	Difference between facility and no-action case.
		NOx	N.A.	-0.0278	Negative number = emissions decrease.

Site: Kingwood Park & Ride - Modification

I. Assumptions

Existing facility with Modifications.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume				
Lot capacity	vehicles	-	100	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity	-	70.5%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day	71	71	Capacity * utilization rate
B. Personal Vehicle Trip Emissions				
Average distance	miles 1-way	5	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph	30	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes	10.0	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%	84.2%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.

Emission factors	g/veh-mi	VOC	1.562	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
		NOx	1.672	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip	g/veh,	VOC	7.81	6.93	(Emission factor) * (trip distance)
	1-way	NOx	8.36	6.16	
Total vehicle emissions	g/day,	VOC	1,109	984	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
	all round trips	NOx	1,187	875	
	tons/day,	VOC	0.0012	0.0011	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
	all round trips	NOx	0.0013	0.0010	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	205	Daily bus-miles		0	No added bus service due to park & ride facility modification, per METRO (P&R SIP Commitment Analysis.XLS, 5/23/00) Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions		tons/day	VOC	0.0000	Sum of all Bus Routes
			NOx	0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0012	0.0011	From II. B above
		NOx	0.0013	0.0010	
Bus emissions	tons/day	VOC	0.0000	0.0000	From II. C above
		NOx	0.0000	0.0000	
Total emissions, all vehicles	tons/day	VOC	0.0012	0.0011	Sum of personal vehicle + bus
		NOx	0.0013	0.0010	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0001	Difference between facility and no-action case.
		NOx	N.A.	-0.0003	Negative number = emissions decrease.

Site: Northwest Station - Second Expansion

I. Assumptions

Existing facility with Expansion.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume				
Lot capacity	vehicles	-	562	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity	-	104.6%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day	588	588	Capacity * utilization rate
B. Personal Vehicle Trip Emissions				
Average distance	miles 1-way	17.5	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph	55	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes	19.1	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%	44.1%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.

Emission factors	g/veh-mi	VOC	0.868	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
		NOx	1.901	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip	g/veh,	VOC	15.20	6.93	(Emission factor) * (trip distance)
	1-way	NOx	33.26	6.16	
Total vehicle emissions	g/day,	VOC	17,872	8,152	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
	all round trips	NOx	39,115	7,244	
	tons/day,	VOC	0.0197	0.0090	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
	all round trips	NOx	0.0431	0.0080	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	214	Daily bus-miles		0	No added bus service due to park & ride facility expansion, per METRO (P&R SIP Commitment Analysis.XLS, 5/23/00) Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions		tons/day	VOC	0.0000	Sum of all Bus Routes
			NOx	0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0197	0.0090	From II. B above
		NOx	0.0431	0.0080	
Bus emissions	tons/day	VOC	0.0000	0.0000	From II. C above
		NOx	0.0000	0.0000	
Total emissions, all vehicles	tons/day	VOC	0.0197	0.0090	Sum of personal vehicle + bus
		NOx	0.0431	0.0080	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0107	Difference between facility and no-action case.
		NOx	N.A.	-0.0351	Negative number = emissions decrease.

Site: Addicks Park & Ride - Second Expansion Phase 1

I. Assumptions

Existing facility with Expansion.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume				
Lot capacity	vehicles	-	398	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity	-	86.6%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day	345	345	Capacity * utilization rate
B. Personal Vehicle Trip Emissions				
Average distance	miles 1-way	17.5	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph	30	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes	35.0	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%	24.0%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.

Emission factors	g/veh-mi	VOC	1.077	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
		NOx	1.366	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip	g/veh,	VOC	18.85	6.93	(Emission factor) * (trip distance)
	1-way	NOx	23.91	6.16	
Total vehicle emissions	g/day,	VOC	13,006	4,783	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
	all round trips	NOx	16,496	4,250	
	tons/day,	VOC	0.0143	0.0053	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
	all round trips	NOx	0.0182	0.0047	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	228,285	Daily bus-miles		0	No added bus service due to park & ride facility expansion, per METRO (P&R SIP Commitment Analysis.XLS, 5/23/00) Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions		tons/day	VOC	0.0000	Sum of all Bus Routes
			NOx	0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0143	0.0053	From II. B above
		NOx	0.0182	0.0047	
Bus emissions	tons/day	VOC	0.0000	0.0000	From II. C above
		NOx	0.0000	0.0000	
Total emissions, all vehicles	tons/day	VOC	0.0143	0.0053	Sum of personal vehicle + bus
		NOx	0.0182	0.0047	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0091	Difference between facility and no-action case.
		NOx	N.A.	-0.0135	Negative number = emissions decrease.

Site: Bay Area Blvd. Park & Pool

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, LDDT.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, access trip for all vehicles is line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity	vehicles		-	207	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles	% capacity		-	120.3%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume	veh/day		249	249	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	miles 1-way		20	3.6	METRO (99P&RDATA.XLS, 11/24/99) Access trip w/o facility = line-haul trip in non-HOV lanes.
Average speed	mph		55	25	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	minutes		21.8	8.6	Distance/speed * (60 min/hr)
% of time in cold start mode	%		38.6%	97.4%	(505 sec)/(trip time) Cold start % varied based on speed/trip length.
Emission factors	g/veh-mi	VOC	0.838	1.925	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
		NOx	1.864	1.711	Emission Factors are a composite based on % of time in cold start mode.
Emissions per vehicle trip	g/veh, 1-way	VOC	16.77	6.93	(Emission factor) * (trip distance)
		NOx	37.28	6.16	

Total vehicle emissions		g/day, all round trips	VOC	8,351	3,452	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
			NOx	18,565	3,068	
		tons/day, all round trips	VOC	0.0092	0.0038	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
			NOx	0.0204	0.0034	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route					
"New" Bus VMT/day	246	Daily bus-miles			195.64	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Daily Total Miles (not Revenue Miles) by Bus Route
Line-haul ave. speed	246	mph			27	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Speed by Bus Route
Bus emission factors	246	g/veh-mi	VOC		1.722	MOBILE5a_H with HGAC parameters (R. Kandalam fax 4/29/99)
			NOx		9.842	Emission Factors by Bus Route
Bus emissions	246	g/day	VOC		337	(Emission factor) * (bus VMT)
			NOx		1,925	Bus Emissions by Bus Route
Bus total emissions		tons/day	VOC		0.0004	Sum of all Bus Routes
			NOx		0.0021	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0092	0.0038	From II. B above
		NOx	0.0204	0.0034	
Bus emissions	tons/day	VOC	0.0000	0.0004	From II. C above
		NOx	0.0000	0.0021	
Total emissions, all vehicles	tons/day	VOC	0.0092	0.0042	Sum of personal vehicle + bus
		NOx	0.0204	0.0055	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0050	Difference between facility and no-action case.
		NOx	N.A.	-0.0149	Negative number = emissions decrease.

Personal Veh. Mobile 5A_H Emission Factors (1999 from HGAC regional mix)

100% Cold Start				0% Cold Start			
Speed	**CO**	**VOC**	**NOX**	**Speed**	**CO**	**VOC**	**NOX**
2.5	107.516	12.911	2.516	2.5	49.352	7.141	1.787
3.0	91.188	10.653	2.356	3.0	41.888	5.755	1.673
4.0	70.688	7.986	2.156	4.0	32.453	4.180	1.532
5.0	58.338	6.467	2.036	5.0	26.735	3.319	1.446
6.0	50.089	5.489	1.956	6.0	22.905	2.779	1.389
7.0	44.194	4.807	1.898	7.0	20.166	2.411	1.348
8.0	39.774	4.349	1.855	8.0	18.114	2.189	1.318
9.0	36.339	3.994	1.822	9.0	16.521	2.017	1.294
10.0	33.595	3.708	1.795	10.0	15.251	1.877	1.275
11.0	31.352	3.471	1.773	11.0	14.215	1.760	1.259
12.0	29.486	3.272	1.755	12.0	13.354	1.660	1.246
13.0	27.908	3.101	1.740	13.0	12.628	1.574	1.235
14.0	26.557	2.953	1.726	14.0	12.007	1.498	1.226
15.0	25.387	2.822	1.715	15.0	11.469	1.430	1.218
16.0	24.362	2.706	1.705	16.0	10.998	1.369	1.211
17.0	23.458	2.602	1.697	17.0	10.583	1.314	1.205
18.0	22.654	2.508	1.689	18.0	10.212	1.263	1.199
19.0	21.933	2.423	1.683	19.0	9.880	1.216	1.194
20.0	21.077	2.331	1.683	20.0	9.500	1.171	1.195
21.0	20.050	2.241	1.693	21.0	9.052	1.131	1.202
22.0	19.114	2.159	1.702	22.0	8.643	1.095	1.208
23.0	18.259	2.084	1.710	23.0	8.268	1.061	1.214
24.0	17.473	2.014	1.717	24.0	7.922	1.030	1.219
25.0	16.749	1.950	1.724	25.0	7.603	1.002	1.224
26.0	16.079	1.891	1.731	26.0	7.307	0.975	1.229
27.0	15.458	1.836	1.737	27.0	7.032	0.950	1.233
28.0	14.881	1.784	1.742	28.0	6.775	0.926	1.237
29.0	14.343	1.736	1.748	29.0	6.536	0.904	1.241
30.0	13.840	1.690	1.752	30.0	6.312	0.883	1.244
31.0	13.370	1.648	1.757	31.0	6.102	0.864	1.247
32.0	12.929	1.608	1.761	32.0	5.906	0.845	1.251
33.0	12.515	1.570	1.765	33.0	5.721	0.827	1.253
34.0	12.125	1.534	1.769	34.0	5.548	0.810	1.256
35.0	11.759	1.500	1.773	35.0	5.385	0.795	1.259
36.0	11.413	1.468	1.776	36.0	5.232	0.779	1.261
37.0	11.087	1.438	1.780	37.0	5.088	0.765	1.264
38.0	10.778	1.409	1.783	38.0	4.952	0.751	1.266

39.0	10.487	1.382	1.786	39.0	4.825	0.738	1.268
40.0	10.210	1.356	1.789	40.0	4.704	0.725	1.270
41.0	9.948	1.331	1.791	41.0	4.591	0.713	1.272
42.0	9.700	1.307	1.794	42.0	4.484	0.702	1.274
43.0	9.463	1.284	1.797	43.0	4.383	0.690	1.276
44.0	9.238	1.262	1.799	44.0	4.287	0.680	1.278
45.0	9.024	1.241	1.802	45.0	4.196	0.669	1.280
46.0	8.820	1.221	1.804	46.0	4.110	0.659	1.281
47.0	8.625	1.202	1.806	47.0	4.028	0.650	1.283
48.0	8.438	1.183	1.809	48.0	3.950	0.640	1.285
49.0	8.438	1.181	1.875	49.0	3.950	0.639	1.331
50.0	8.438	1.180	1.941	50.0	3.950	0.637	1.377
51.0	8.438	1.178	2.007	51.0	3.950	0.635	1.423
52.0	8.438	1.176	2.074	52.0	3.950	0.634	1.469
53.0	8.438	1.175	2.140	53.0	3.950	0.632	1.515
54.0	8.438	1.173	2.206	54.0	3.950	0.631	1.561
55.0	8.438	1.172	2.273	55.0	3.950	0.629	1.607
56.0	9.449	1.199	2.339	56.0	4.521	0.648	1.653
57.0	10.460	1.225	2.405	57.0	5.091	0.666	1.699
58.0	11.471	1.252	2.472	58.0	5.662	0.684	1.745
59.0	12.482	1.279	2.538	59.0	6.233	0.702	1.791
60.0	13.493	1.305	2.604	60.0	6.803	0.721	1.837
61.0	14.504	1.332	2.671	61.0	7.374	0.739	1.883
62.0	15.514	1.359	2.737	62.0	7.945	0.758	1.930
63.0	16.525	1.386	2.804	63.0	8.516	0.776	1.976
64.0	17.536	1.413	2.870	64.0	9.086	0.795	2.022
65.0	18.547	1.440	2.936	65.0	9.657	0.814	2.068
66.0	18.547	1.440	2.936	66.0	9.657	0.814	2.068
67.0	18.547	1.440	2.936	67.0	9.657	0.814	2.068
68.0	18.547	1.440	2.936	68.0	9.657	0.814	2.068
69.0	18.547	1.440	2.936	69.0	9.657	0.814	2.068
70.0	18.547	1.440	2.936	70.0	9.657	0.814	2.068
71.0	18.547	1.440	2.936	71.0	9.657	0.814	2.068
72.0	18.547	1.440	2.936	72.0	9.657	0.814	2.068
73.0	18.547	1.440	2.936	73.0	9.657	0.814	2.068
74.0	18.547	1.440	2.936	74.0	9.657	0.814	2.068
75.0	18.547	1.440	2.936	75.0	9.657	0.814	2.068

Bus Mobile 5A_H Emission Factors (1999 HDDV)

Speed	CO	VOC	NOX
2.5	37.454	4.821	19.096
3.0	35.932	4.696	18.679
4.0	33.115	4.458	17.893
5.0	30.575	4.237	17.163
6.0	28.281	4.029	16.487
7.0	26.207	3.836	15.860
8.0	24.329	3.654	15.279
9.0	22.627	3.485	14.740
10.0	21.082	3.326	14.240
11.0	19.679	3.177	13.776
12.0	18.402	3.038	13.347
13.0	17.240	2.907	12.949
14.0	16.180	2.784	12.581
15.0	15.213	2.669	12.241
16.0	14.331	2.561	11.927
17.0	13.523	2.459	11.637
18.0	12.785	2.364	11.371
19.0	12.109	2.274	11.127
20.0	11.489	2.190	10.903
21.0	10.922	2.110	10.699
22.0	10.401	2.035	10.514
23.0	9.923	1.965	10.346
24.0	9.484	1.899	10.196
25.0	9.081	1.836	10.062
26.0	8.711	1.777	9.944
27.0	8.371	1.722	9.842
28.0	8.060	1.670	9.754
29.0	7.774	1.621	9.681
30.0	7.511	1.574	9.622
31.0	7.271	1.530	9.577
32.0	7.052	1.489	9.545
33.0	6.851	1.451	9.528
34.0	6.668	1.414	9.524
35.0	6.502	1.380	9.533
36.0	6.352	1.347	9.556
37.0	6.217	1.317	9.593
38.0	6.095	1.288	9.643
39.0	5.987	1.261	9.708
40.0	5.891	1.236	9.787

41.0	5.807	1.212	9.880
42.0	5.735	1.190	9.989
43.0	5.675	1.169	10.113
44.0	5.625	1.150	10.253
45.0	5.586	1.132	10.410
46.0	5.557	1.115	10.584
47.0	5.538	1.099	10.777
48.0	5.529	1.085	10.989
49.0	5.531	1.072	11.220
50.0	5.542	1.059	11.473
51.0	5.564	1.048	11.749
52.0	5.596	1.038	12.048
53.0	5.639	1.029	12.372
54.0	5.692	1.021	12.723
55.0	5.756	1.014	13.102
56.0	5.831	1.008	13.512
57.0	5.918	1.002	13.955
58.0	6.018	0.998	14.432
59.0	6.130	0.994	14.947
60.0	6.255	0.992	15.503
61.0	6.395	0.990	16.102
62.0	6.550	0.989	16.748
63.0	6.721	0.989	17.444
64.0	6.909	0.990	18.196
65.0	7.115	0.992	19.006
66.0	7.115	0.992	19.006
67.0	7.115	0.992	19.006
68.0	7.115	0.992	19.006
69.0	7.115	0.992	19.006
70.0	7.115	0.992	19.006
71.0	7.115	0.992	19.006
72.0	7.115	0.992	19.006
73.0	7.115	0.992	19.006
74.0	7.115	0.992	19.006
75.0	7.115	0.992	19.006

Houston METRO - Transit/Transportation Control Measures Rev. 11/01/00
Air Quality Analyses PARKRIDE10-2007.XLS
Analysis of SIP Commitments for PARK & RIDE FACILITIES for 2007

PARK & RIDE FACILITIES SUMMARY

Park & Ride Facility	Net Emissions Change in 2007 (tons/day) VOC	NOx
Tidwell Transit Center	-0.00035	-0.0006
Mesa Transit Center	-0.0003	-0.0005
Hillcroft Transit Center	-0.0023	-0.0037
Mission Bend Park & Ride	-0.0003	-0.0002
West Bellfort Park & Ride	-0.0096	-0.0109
Kingwood Park & Ride - Modification	-0.0031	-0.0051
Northwest Station - Second Expansion	-0.0234	-0.0389
Addicks Park & Ride - Second Expansion Phase 1	-0.0229	-0.0381
Bay Area Boulevard Park & Pool	-0.0026	-0.0038
Total all facilities (negative number indicates emissions decrease)	-0.0649	-0.1017

Site: Tidwell Transit Center

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	809	METRO (2007 P&R SUMMARY.XLS, 10/19/00)
Utilization rate, daily vehicles		% capacity	-	10.0%	METRO (2007 P&R SUMMARY.XLS, 10/19/00) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	81	81	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	6	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	9.6	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)

Average trip time	Access	minutes		8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes		8.0	N.A.	
	Total	minutes		16.6	8.6	
% of time or VMT in	Access	%		97.4%	97.4%	(505 sec)/(trip time) by trip leg
cold start mode	Line-Haul	%		0.0%	N.A.	Cold start % varied based on speed/trip length.
Emission factors, avg.		g/veh-mi	VOC	0.539	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs		g/veh-mi	NOx	0.607	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip		g/veh,	VOC	5.176	3.221	(Emission factor) * (trip distance)
		1-way	NOx	5.825	2.579	
Total vehicle emissions		g/day,	VOC	838	522	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	944	418	
		tons/day,	VOC	0.0009	0.0006	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0010	0.0005	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route					
"New" Bus VMT/day	4,45,54, 57,83	Daily bus-miles			0	No added bus service due to park & ride facility, per METRO (*Park & Ride SIP Commitment Analysis* , 5/2/00). Same for 2007 per METRO (L.Mifsud phone 10/26/00). Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions		tons/day	VOC		0.0000	Sum of all Bus Routes
			NOx		0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.00092	0.00057	From II. B above
		NOx	0.0010	0.0005	
Bus emissions	tons/day	VOC	0.00000	0.00000	From II. C above
		NOx	0.0000	0.0000	

Total emissions, all vehicles	tons/day	VOC	0.00092	0.00057	Sum of personal vehicle + bus
		NOx	0.0010	0.0005	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.00035	Difference between facility and no-action case.
		NOx	N.A.	-0.0006	Negative number = emissions decrease.

Site: Mesa Transit Center

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	100	METRO (2007 P&R SUMMARY.XLS, 10/19/00)
Utilization rate, daily vehicles		% capacity	-	90.0%	METRO (2007 P&R SUMMARY.XLS, 10/19/00) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	90	90	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	5	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	8.6	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)

Average trip time	Access	minutes		8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes		6.7	N.A.	
	Total	minutes		15.3	8.6	
% of time or VMT in	Access	%		97.4%	97.4%	(505 sec)/(trip time) by trip leg
cold start mode	Line-Haul	%		0.0%	N.A.	Cold start % varied based on speed/trip length.
Emission factors, avg.		g/veh-mi	VOC	0.564	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs		g/veh-mi	NOx	0.614	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip		g/veh,	VOC	4.85	3.22	(Emission factor) * (trip distance)
		1-way	NOx	5.28	2.58	
Total vehicle emissions		g/day,	VOC	873	580	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	951	464	
		tons/day,	VOC	0.0010	0.0006	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0010	0.0005	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	-	Daily bus-miles		0	No added bus service due to park & ride facility, per METRO (*Park & Ride SIP Commitment Analysis* , 5/2/00). Same for 2007 per METRO (L.Mifsud phone 10/26/00). Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions		tons/day	VOC	0.0000	Sum of all Bus Routes
			NOx	0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0010	0.0006	From II. B above
		NOx	0.0010	0.0005	
Bus emissions	tons/day	VOC	0.0000	0.0000	From II. C above
		NOx	0.0000	0.0000	

Total emissions, all vehicles	tons/day	VOC	0.0010	0.0006	Sum of personal vehicle + bus
		NOx	0.0010	0.0005	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0003	Difference between facility and no-action case.
		NOx	N.A.	-0.0005	Negative number = emissions decrease.

Site: Hillcroft Transit Center

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	895	METRO (2007 P&R SUMMARY.XLS, 10/19/00)
Utilization rate, daily vehicles		% capacity	-	75.0%	METRO (2007 P&R SUMMARY.XLS, 10/19/00) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	671	671	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	5.28	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	8.88	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	Access	minutes	8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes	7.0	N.A.	
	Total	minutes	15.7	8.6	

% of time or VMT in	Access	%		97.4%	97.4%	(505 sec)/(trip time) by trip leg
cold start mode	Line-Haul	%		0.0%	N.A.	Cold start % varied based on speed/trip length.
Emission factors, avg.		g/veh-mi	VOC	0.556	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs		g/veh-mi	NOx	0.612	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip		g/veh,	VOC	4.94	3.22	(Emission factor) * (trip distance)
		1-way	NOx	5.44	2.58	
Total vehicle emissions		g/day,	VOC	6,631	4,322	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	7,294	3,461	
		tons/day,	VOC	0.0073	0.0048	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0080	0.0038	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route					
"New" Bus VMT/day	132	Daily bus-miles			16.52	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Same for 2007 per METRO (L.Mifsud phone 10/26/00).
	163				56.76	Daily Total Miles (not Revenue Miles) by Bus Route
Line-haul ave. speed	132	mph			13	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	163				13	Speed by Bus Route
Bus emission factors	132	g/veh-mi	VOC		2.751	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
			NOx		7.030	Emission Factors by Bus Route
	163	g/veh-mi	VOC		2.751	
			NOx		7.030	
Bus emissions	132	g/day	VOC		45	(Emission factor) * (bus VMT)
			NOx		116	Bus Emissions by Bus Route
	163	g/day	VOC		156	
			NOx		399	
Bus total emissions		tons/day	VOC		0.0002	Sum of all Bus Routes
			NOx		0.0006	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

	No-Action	**With Facility**

Variable	Units		Value	Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0073	0.0048	From II. B above
		NOx	0.0080	0.0038	
Bus emissions	tons/day	VOC	0.0000	0.0002	From II. C above
		NOx	0.0000	0.0006	
Total emissions, all vehicles	tons/day	VOC	0.0073	0.0050	Sum of personal vehicle + bus
		NOx	0.0080	0.0044	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0023	Difference between facility and no-action case.
		NOx	N.A.	-0.0037	Negative number = emissions decrease.

Site: Mission Bend Park & Ride - NOT INCLUDED IN 2007 SIP COMMITMENT

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	826	METRO (99P&RDATA.XLS, 11/24/99)
Utilization rate, daily vehicles		% capacity	-	12.3%	METRO (99P&RDATA.XLS, 11/24/99) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	102	102	Capacity * utilization rate.
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	7.5	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	11.1	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)

Average trip time	Access	minutes		8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes		10.0	N.A.	
	Total	minutes		18.6	8.6	
% of time or VMT in	Access	%		97.4%	97.4%	(505 sec)/(trip time) by trip leg
cold start mode	Line-Haul	%		0.0%	N.A.	Cold start % varied based on speed/trip length.
Emission factors, avg.		g/veh-mi	VOC	0.510	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs		g/veh-mi	NOx	0.598	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip		g/veh,	VOC	5.66	3.22	(Emission factor) * (trip distance)
		1-way	NOx	6.64	2.58	
Total vehicle emissions		g/day,	VOC	1,156	657	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	1,354	526	
		tons/day,	VOC	0.0013	0.0007	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0015	0.0006	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route					
"New" Bus VMT/day	2	Daily bus-miles			58.26	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	25				0	Daily Total Miles (not Revenue Miles) by Bus Route
	132				28.91	Route 25 listed as "NA" in METRO data; zero entered as placeholder.
Line-haul ave. speed	2	mph			11	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00).
	25				12	Speed by Bus Route
	132				16	
Bus emission factors	2	g/veh-mi	VOC		3.007	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
			NOx		7.479	Emission Factors by Bus Route
	25	g/veh-mi	VOC		2.875	
			NOx		7.246	
	132	g/veh-mi	VOC		2.424	
			NOx		6.475	

Bus emissions	2	g/day	VOC	175	(Emission factor) * (bus VMT)
			NOx	436	Bus Emissions by Bus Route
	25	g/day	VOC	0	
			NOx	0	
	132	g/day	VOC	70	
			NOx	187	
Bus total emissions		tons/day	VOC	0.0003	Sum of all Bus Routes
			NOx	0.0007	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0013	0.0007	From II. B above

		NOx	0.0015	0.0006	
Bus emissions	tons/day	VOC	0.0000	0.0003	From II. C above
		NOx	0.0000	0.0007	
Total emissions, all vehicles	tons/day	VOC	0.0013	0.0010	Sum of personal vehicle + bus
		NOx	0.0015	0.0013	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0003	Difference between facility and no-action case.
		NOx	N.A.	-0.0002	Negative number = emissions decrease.

Site: West Bellfort Park & Ride

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	1,200	METRO (2007 P&R SUMMARY.XLS, 10/19/00)
Utilization rate, daily vehicles		% capacity	-	100.0%	METRO (2007 P&R SUMMARY.XLS, 10/19/00) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	1,200	1,200	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	15	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	18.6	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	Access	minutes	8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes	20.0	N.A.	
	Total	minutes	28.6	8.6	
% of time or VMT in cold start mode	Access	%	97.4%	97.4%	(505 sec)/(trip time) by trip leg
	Line-Haul	%	0.0%	N.A.	Cold start % varied based on speed/trip length.

Emission factors, avg.	g/veh-mi	VOC	0.436	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs	g/veh-mi	NOx	0.575	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip	g/veh,	VOC	8.11	3.22	(Emission factor) * (trip distance)
	1-way	NOx	10.69	2.58	
Total vehicle emissions	g/day,	VOC	19,460	7,730	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
	all round trips	NOx	25,665	6,189	
	tons/day,	VOC	0.0214	0.0085	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
	all round trips	NOx	0.0283	0.0068	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	265	Daily bus-miles		1,778.98	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Same for 2007 per METRO (L.Mifsud phone 10/26/00). Daily Total Miles (not Revenue Miles) by Bus Route
Line-haul ave. speed	8	mph		26	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Speed by Bus Route
Bus emission factors	265	g/veh-mi	VOC	1.682	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
			NOx	5.399	Emission Factors by Bus Route
Bus emissions	265	g/day	VOC	2,992	(Emission factor) * (bus VMT)
			NOx	9,604	Bus Emissions by Bus Route
Bus total emissions		tons/day	VOC	0.0033	Sum of all Bus Routes
			NOx	0.0106	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0214	0.0085	From II. B above
		NOx	0.0283	0.0068	
Bus emissions	tons/day	VOC	0.0000	0.0033	From II. C above
		NOx	0.0000	0.0106	
Total emissions, all vehicles	tons/day	VOC	0.0214	0.0118	Sum of personal vehicle + bus
		NOx	0.0283	0.0174	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0096	Difference between facility and no-action case.

NOx	N.A.	-0.0109	Negative number = emissions decrease.

Site: Kingwood Park & Ride - Modification

I. Assumptions

Existing facility with Modifications.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	1,034	METRO (2007 P&R SUMMARY.XLS, 10/19/00)
Utilization rate, daily vehicles		% capacity	-	82.5%	METRO (2007 P&R SUMMARY.XLS, 10/19/00) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	853	853	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	5	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	8.6	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	Access	minutes	8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes	6.7	N.A.	
	Total	minutes	15.3	8.6	

% of time or VMT in	Access	%		97.4%	97.4%	(505 sec)/(trip time) by trip leg
cold start mode	Line-Haul	%		0.0%	N.A.	Cold start % varied based on speed/trip length.
Emission factors, avg.		g/veh-mi	VOC	0.564	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs		g/veh-mi	NOx	0.614	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip		g/veh,	VOC	4.85	3.22	(Emission factor) * (trip distance)
		1-way	NOx	5.28	2.58	
Total vehicle emissions		g/day,	VOC	8,274	5,495	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	9,014	4,399	
		tons/day,	VOC	0.0091	0.0061	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0099	0.0048	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	205	Daily bus-miles		0	No added bus service due to park & ride facility modification, per METRO (P&R SIP Commitment Analysis.XLS, 5/23/00) Same for 2007 per METRO (L.Mifsud phone 10/26/00). Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions		tons/day	VOC	0.0000	Sum of all Bus Routes
			NOx	0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0091	0.0061	From II. B above
		NOx	0.0099	0.0048	
Bus emissions	tons/day	VOC	0.0000	0.0000	From II. C above
		NOx	0.0000	0.0000	
Total emissions, all vehicles	tons/day	VOC	0.0091	0.0061	Sum of personal vehicle + bus
		NOx	0.0099	0.0048	

Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0031	Difference between facility and no-action case.
		NOx	N.A.	-0.0051	Negative number = emissions decrease.

Site: Northwest Station - Second Expansion

I. Assumptions

Existing facility with Expansion.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	1,755	METRO (2007 P&R SUMMARY.XLS, 10/19/00)
Utilization rate, daily vehicles		% capacity	-	106.2%	METRO (2007 P&R SUMMARY.XLS, 10/19/00) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	1,864	1,864	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	17.5	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	21.1	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	Access	minutes	8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes	23.3	N.A.	
	Total	minutes	32.0	8.6	

% of time or VMT in	Access	%		97.4%	97.4%	(505 sec)/(trip time) by trip leg
cold start mode	Line-Haul	%		0.0%	N.A.	Cold start % varied based on speed/trip length.
Emission factors, avg.		g/veh-mi	VOC	0.423	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs		g/veh-mi	NOx	0.571	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip		g/veh,	VOC	8.92	3.22	(Emission factor) * (trip distance)
		1-way	NOx	12.05	2.58	
Total vehicle emissions		g/day,	VOC	33,265	12,008	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	44,909	9,613	
		tons/day,	VOC	0.0366	0.0132	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0495	0.0106	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	214	Daily bus-miles		0	No added bus service due to park & ride facility expansion, per METRO (P&R SIP Commitment Analysis.XLS, 5/23/00) Same for 2007 per METRO (L.Mifsud phone 10/26/00). Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions		tons/day	VOC	0.0000	Sum of all Bus Routes
			NOx	0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0366	0.0132	From II. B above
		NOx	0.0495	0.0106	
Bus emissions	tons/day	VOC	0.0000	0.0000	From II. C above
		NOx	0.0000	0.0000	
Total emissions, all vehicles	tons/day	VOC	0.0366	0.0132	Sum of personal vehicle + bus
		NOx	0.0495	0.0106	

Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0234	Difference between facility and no-action case.
		NOx	N.A.	-0.0389	Negative number = emissions decrease.

Site: Addicks Park & Ride - Second Expansion Phase 1

I. Assumptions

Existing facility with Expansion.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	1,999	METRO (2007 P&R SUMMARY.XLS, 10/19/00)
Utilization rate, daily vehicles		% capacity	-	91.4%	METRO (2007 P&R SUMMARY.XLS, 10/19/00) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	1,827	1,827	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	17.5	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	21.1	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	Access	minutes	8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes	23.3	N.A.	
	Total	minutes	32.0	8.6	

% of time or VMT in	Access	%		97.4%	97.4%	(505 sec)/(trip time) by trip leg
cold start mode	Line-Haul	%		0.0%	N.A.	Cold start % varied based on speed/trip length.
Emission factors, avg.		g/veh-mi	VOC	0.423	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs		g/veh-mi	NOx	0.571	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip		g/veh,	VOC	8.92	3.22	(Emission factor) * (trip distance)
		1-way	NOx	12.05	2.58	
Total vehicle emissions		g/day,	VOC	32,604	11,769	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	44,017	9,422	
		tons/day,	VOC	0.0359	0.0130	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0485	0.0104	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route				
"New" Bus VMT/day	228,285	Daily bus-miles		0	No added bus service due to park & ride facility expansion, per METRO (P&R SIP Commitment Analysis.XLS, 5/23/00) Same for 2007 per METRO (L.Mifsud phone 10/26/00). Daily Total Miles (not Revenue Miles) by Bus Route
Bus total emissions		tons/day	VOC	0.0000	Sum of all Bus Routes
			NOx	0.0000	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0359	0.0130	From II. B above
		NOx	0.0485	0.0104	
Bus emissions	tons/day	VOC	0.0000	0.0000	From II. C above
		NOx	0.0000	0.0000	
Total emissions, all vehicles	tons/day	VOC	0.0359	0.0130	Sum of personal vehicle + bus
		NOx	0.0485	0.0104	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0229	Difference between facility and no-action case.

NOx	N.A.	-0.0381	Negative number = emissions decrease.

Site: Bay Area Boulevard Park & Pool

I. Assumptions

New facility.
All users arrive by personal vehicle, with vehicle occupancy equal to regional average.
Personal vehicles assumed to consist of MOBILE5 types LDGV, LDGT1, LDDV, MC.
Emission factors for both personal vehicles and buses (HDDV) are from MOBILE5b per TTI/TNRCC.
All personal vehicles begin access trip with cold start (no hot starts or stabilized).
No users arrive by walk, bicycle, or "kiss & ride" (dropoff/pickup). Assumption not revised, per METRO discussion.
All users ride the bus - no carpool or vanpool staging at lot. Assumption not revised, per METRO discussion. Vanpool staging accounted for separately in vanpool analysis.
For "No-Action" case, trip distance for all vehicles is assumed to equal sum of facility access trip and line-haul trip to final destination.

II. Emission Calculations by Trip Segment and Mode

Variable		Units	No-Action Value	With Facility Value	Sources/Notes
A. Facility Usage Rates and Vehicle Volume					
Lot capacity		vehicles	-	207	METRO (2007 P&R SUMMARY.XLS, 10/19/00)
Utilization rate, daily vehicles		% capacity	-	100.0%	METRO (2007 P&R SUMMARY.XLS, 10/19/00) Utilization interpreted as vehicles parked in spaces, not persons.
Daily vehicle demand volume		veh/day	207	207	Capacity * utilization rate
B. Personal Vehicle Trip Emissions					
Average distance	Access	miles 1-way	3.6	3.6	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	miles 1-way	20	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
	Total	miles 1-way	23.6	3.6	METRO (L.Mifsud phone 10/30/00, for use of sum of distances without facility)
Average speed	Access	mph	25	25	METRO (99P&RDATA.XLS, 11/24/99)
	Line-Haul	mph	45	N.A.	METRO (99P&RDATA.XLS, 11/24/99)
Average trip time	Access	minutes	8.6	8.6	Distance/speed * (60 min/hr)
	Line-Haul	minutes	26.7	N.A.	
	Total	minutes	35.3	8.6	

% of time or VMT in	Access	%		97.4%	97.4%	(505 sec)/(trip time) by trip leg
cold start mode	Line-Haul	%		0.0%	N.A.	Cold start % varied based on speed/trip length.
Emission factors, avg.		g/veh-mi	VOC	0.413	0.895	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
over all trip legs		g/veh-mi	NOx	0.568	0.716	Emission factors are composite based on % time in cold start mode by trip leg.
Emissions per vehicle trip		g/veh,	VOC	9.74	3.22	(Emission factor) * (trip distance)
		1-way	NOx	13.40	2.58	
Total vehicle emissions		g/day,	VOC	4,031	1,333	(1-Way emissions/vehicle) * (2 trips/day) * (number of vehicles/day)
		all round trips	NOx	5,547	1,068	
		tons/day,	VOC	0.0044	0.0015	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)
		all round trips	NOx	0.0061	0.0012	

C. Line-Haul Bus Trip From Lot to Final Destination

	Bus Route					
"New" Bus VMT/day	246	Daily bus-miles			195.64	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Same for 2007 per METRO (L.Mifsud phone 10/26/00). Daily Total Miles (not Revenue Miles) by Bus Route
Line-haul ave. speed	246	mph			27	METRO (P&R SIP Commitment Analysis.XLS, 5/23/00). Speed by Bus Route
Bus emission factors	246	g/veh-mi	VOC		1.630	MOBILE5b (e-mail 10/13/00 Teresa Qu (TTI) to David Ernst (KM Chng)).
			NOx		5.343	Emission Factors by Bus Route
Bus emissions	246	g/day	VOC		319	(Emission factor) * (bus VMT)
			NOx		1,045	Bus Emissions by Bus Route
Bus total emissions		tons/day	VOC		0.0004	Sum of all Bus Routes
			NOx		0.0012	Conversion: (g/day) / (454 g/lb) / (2000 lb/ton)

III. Net Emissions Impact

Variable	Units		No-Action Value	With Facility Value	Sources/Notes
Personal vehicle emissions	tons/day	VOC	0.0044	0.0015	From II. B above
		NOx	0.0061	0.0012	
Bus emissions	tons/day	VOC	0.0000	0.0004	From II. C above

		NOx	0.0000	0.0012	
Total emissions, all vehicles	tons/day	VOC	0.0044	0.0018	Sum of personal vehicle + bus
		NOx	0.0061	0.0023	
Net emissions change, all vehicles	tons/day	VOC	N.A.	-0.0026	Difference between facility and no-action case.
		NOx	N.A.	-0.0038	Negative number = emissions decrease.

EMISSION FACTORS FOR PERSONAL VEHICLES - 2007

Source: MOBILE5b runs with TTI/TNRCC parameters, per e-mail from Teresa Qu (TTI) to David Ernst (KM Chng) 10/13/00). Used TTI files HA0724T1.TR2 with operating modes 100%,0%,100%, and HA0724T2.TR2 with operating modes 0%,0%,0%. Emission factors for specific cold start % are derived for lookup tables by weighting these two runs. To derive emission factors for personal vehicles, only types LDGV, LDGT1, LDDV, and MC are used, and VMT mix has been renormalized. VMT mix for normalizing was provided by e-mail from Dennis Perkinson (TTI) to David Ernst (KM Chng) 10/13/00, as file VMIX_ONE.LST.

Range name: Personal_Veh_100_CS

2007 Personal Vehicles - 100% Cold Start

Speed	CO	VOC	NOx
3	47.241	4.767	0.992
4	37.067	3.527	0.907
5	30.959	2.842	0.856
6	26.884	2.410	0.822
7	23.972	2.114	0.797
8	21.788	1.921	0.779
9	20.089	1.772	0.765
10	18.730	1.653	0.753
11	17.618	1.555	0.744
12	16.691	1.472	0.736
13	15.907	1.402	0.729
14	15.236	1.341	0.724
15	14.653	1.288	0.719
16	14.144	1.241	0.715
17	13.694	1.200	0.711
18	13.294	1.162	0.708
19	12.937	1.129	0.705
20	12.405	1.087	0.705
21	11.721	1.044	0.709
22	11.100	1.005	0.713
23	10.532	0.969	0.716
24	10.012	0.936	0.719
25	9.533	0.906	0.722
26	9.091	0.878	0.724
27	8.682	0.852	0.726
28	8.301	0.827	0.729
29	7.948	0.805	0.731
30	7.617	0.784	0.732
31	7.308	0.764	0.734
32	7.019	0.745	0.736
33	6.747	0.728	0.737
34	6.491	0.711	0.739
35	6.249	0.695	0.740
36	6.021	0.681	0.742
37	5.806	0.666	0.743
38	5.601	0.653	0.744
39	5.408	0.640	0.745

Range name: Personal_Veh_0_CS

2007 Personal Vehicles - 100% Hot Stable

Speed	CO	VOC	NOx
3	20.979	2.706	0.715
4	16.460	1.916	0.653
5	13.745	1.502	0.616
6	11.934	1.251	0.592
7	10.639	1.084	0.574
8	9.668	0.987	0.561
9	8.912	0.914	0.551
10	8.308	0.855	0.543
11	7.814	0.806	0.536
12	7.402	0.764	0.530
13	7.053	0.729	0.526
14	6.754	0.698	0.521
15	6.495	0.670	0.518
16	6.269	0.646	0.515
17	6.069	0.624	0.512
18	5.891	0.605	0.510
19	5.733	0.587	0.508
20	5.497	0.566	0.508
21	5.195	0.547	0.511
22	4.920	0.529	0.513
23	4.669	0.512	0.516
24	4.439	0.497	0.518
25	4.228	0.483	0.520
26	4.032	0.470	0.522
27	3.852	0.458	0.523
28	3.684	0.446	0.525
29	3.527	0.436	0.526
30	3.381	0.426	0.528
31	3.245	0.417	0.529
32	3.117	0.408	0.530
33	2.996	0.399	0.531
34	2.883	0.392	0.532
35	2.777	0.384	0.533
36	2.676	0.377	0.534
37	2.580	0.370	0.535
38	2.490	0.364	0.536
39	2.405	0.358	0.537

40	5.223	0.628	0.746	40	2.323	0.352	0.538
41	5.048	0.617	0.747	41	2.246	0.346	0.538
42	4.882	0.606	0.748	42	2.172	0.341	0.539
43	4.723	0.595	0.749	43	2.102	0.336	0.540
44	4.571	0.585	0.750	44	2.035	0.331	0.540
45	4.426	0.575	0.751	45	1.971	0.326	0.541
46	4.287	0.566	0.752	46	1.910	0.321	0.542
47	4.155	0.557	0.753	47	1.851	0.317	0.542
48	4.027	0.548	0.753	48	1.795	0.312	0.543
49	4.027	0.547	0.778	49	1.795	0.311	0.560
50	4.027	0.546	0.802	50	1.795	0.310	0.577
51	4.027	0.545	0.826	51	1.795	0.309	0.594
52	4.027	0.544	0.851	52	1.795	0.308	0.611
53	4.027	0.543	0.875	53	1.795	0.307	0.628
54	4.027	0.542	0.899	54	1.795	0.306	0.645
55	4.027	0.541	0.924	55	1.795	0.306	0.662
56	4.356	0.549	0.948	56	1.970	0.311	0.679
57	4.685	0.557	0.973	57	2.146	0.317	0.697
58	5.014	0.565	0.997	58	2.322	0.323	0.714
59	5.343	0.573	1.021	59	2.497	0.329	0.731
60	5.672	0.582	1.046	60	2.673	0.335	0.748
61	6.001	0.590	1.070	61	2.848	0.341	0.765
62	6.330	0.598	1.094	62	3.024	0.347	0.782
63	6.659	0.606	1.119	63	3.200	0.353	0.799
64	6.988	0.614	1.143	64	3.375	0.360	0.816
65	7.317	0.623	1.168	65	3.551	0.366	0.833
66				66			
67				67			
68				68			
69				69			
70				70			
71				71			
72				72			
73				73			
74				74			
75				75			

EMISSION FACTORS FOR BUSES (HDDV) - 2007

Source: MOBILE5b with TTI/TNRCC parameters, per e-mail from Teresa Qu (TTI) to David Ernst (KM Chng) 10/13/00). TTI file HA0724T1.TR2 with operating modes 100%, 0%, 100%. Emission factors for HDDV used (insensitive to cold start %).

Range name: Bus_EF

2007 Buses (HDDV)

Speed	CO	VOC	NOx
3	21.167	4.444	10.141
4	19.722	4.219	9.714
5	18.409	4.009	9.318
6	17.215	3.813	8.951
7	16.127	3.630	8.610
8	15.136	3.458	8.295
9	14.232	3.298	8.002
10	13.406	3.147	7.731
11	12.651	3.007	7.479
12	11.960	2.875	7.246
13	11.327	2.751	7.030
14	10.748	2.635	6.830
15	10.217	2.526	6.645
16	9.729	2.424	6.475
17	9.282	2.327	6.318
18	8.872	2.237	6.173
19	8.495	2.152	6.040
20	8.149	2.072	5.919
21	7.831	1.997	5.808
22	7.540	1.926	5.708
23	7.272	1.860	5.617
24	7.027	1.797	5.535
25	6.802	1.738	5.463
26	6.597	1.682	5.399
27	6.409	1.630	5.343
28	6.238	1.580	5.295
29	6.083	1.534	5.256
30	5.942	1.490	5.224
31	5.815	1.448	5.199
32	5.702	1.409	5.182
33	5.600	1.373	5.173
34	5.511	1.338	5.170
35	5.433	1.305	5.175
36	5.365	1.275	5.188
37	5.309	1.246	5.208
38	5.262	1.219	5.235
39	5.225	1.193	5.270
40	5.198	1.169	5.313
41	5.181	1.147	5.364
42	5.173	1.126	5.423
43	5.174	1.106	5.490
44	5.185	1.088	5.566
45	5.205	1.071	5.652
46	5.235	1.055	5.746
47	5.275	1.040	5.851
48	5.324	1.027	5.966
49	5.384	1.014	6.091
50	5.455	1.003	6.229
51	5.536	0.992	6.378

52	5.629	0.982	6.541
53	5.734	0.974	6.716
54	5.852	0.966	6.907
55	5.982	0.959	7.113
56	6.127	0.954	7.336
57	6.287	0.949	7.576
58	6.463	0.944	7.835
59	6.656	0.941	8.115
60	10.141	0.939	8.416
61	9.714	0.937	8.742
62	9.318	0.936	9.092
63	8.951	0.936	9.470
64	8.610	0.937	9.878
65	8.295	0.939	10.318
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Personal Veh. Mobile 5A_H Emission Factors (1999 from HGAC regional mix)

	100% Cold Start				0% Cold Start		
Speed	**CO**	**VOC**	**NOX**	**Speed**	**CO**	**VOC**	**NOX**
2.5	107.516	12.911	2.516	2.5	49.352	7.141	1.787
3.0	91.188	10.653	2.356	3.0	41.888	5.755	1.673
4.0	70.688	7.986	2.156	4.0	32.453	4.180	1.532
5.0	58.338	6.467	2.036	5.0	26.735	3.319	1.446
6.0	50.089	5.489	1.956	6.0	22.905	2.779	1.389
7.0	44.194	4.807	1.898	7.0	20.166	2.411	1.348
8.0	39.774	4.349	1.855	8.0	18.114	2.189	1.318
9.0	36.339	3.994	1.822	9.0	16.521	2.017	1.294
10.0	33.595	3.708	1.795	10.0	15.251	1.877	1.275
11.0	31.352	3.471	1.773	11.0	14.215	1.760	1.259
12.0	29.486	3.272	1.755	12.0	13.354	1.660	1.246
13.0	27.908	3.101	1.740	13.0	12.628	1.574	1.235
14.0	26.557	2.953	1.726	14.0	12.007	1.498	1.226
15.0	25.387	2.822	1.715	15.0	11.469	1.430	1.218
16.0	24.362	2.706	1.705	16.0	10.998	1.369	1.211
17.0	23.458	2.602	1.697	17.0	10.583	1.314	1.205
18.0	22.654	2.508	1.689	18.0	10.212	1.263	1.199
19.0	21.933	2.423	1.683	19.0	9.880	1.216	1.194
20.0	21.077	2.331	1.683	20.0	9.500	1.171	1.195
21.0	20.050	2.241	1.693	21.0	9.052	1.131	1.202
22.0	19.114	2.159	1.702	22.0	8.643	1.095	1.208
23.0	18.259	2.084	1.710	23.0	8.268	1.061	1.214
24.0	17.473	2.014	1.717	24.0	7.922	1.030	1.219
25.0	16.749	1.950	1.724	25.0	7.603	1.002	1.224
26.0	16.079	1.891	1.731	26.0	7.307	0.975	1.229
27.0	15.458	1.836	1.737	27.0	7.032	0.950	1.233
28.0	14.881	1.784	1.742	28.0	6.775	0.926	1.237
29.0	14.343	1.736	1.748	29.0	6.536	0.904	1.241
30.0	13.840	1.690	1.752	30.0	6.312	0.883	1.244
31.0	13.370	1.648	1.757	31.0	6.102	0.864	1.247
32.0	12.929	1.608	1.761	32.0	5.906	0.845	1.251
33.0	12.515	1.570	1.765	33.0	5.721	0.827	1.253
34.0	12.125	1.534	1.769	34.0	5.548	0.810	1.256
35.0	11.759	1.500	1.773	35.0	5.385	0.795	1.259
36.0	11.413	1.468	1.776	36.0	5.232	0.779	1.261
37.0	11.087	1.438	1.780	37.0	5.088	0.765	1.264
38.0	10.778	1.409	1.783	38.0	4.952	0.751	1.266
39.0	10.487	1.382	1.786	39.0	4.825	0.738	1.268
40.0	10.210	1.356	1.789	40.0	4.704	0.725	1.270
41.0	9.948	1.331	1.791	41.0	4.591	0.713	1.272
42.0	9.700	1.307	1.794	42.0	4.484	0.702	1.274

43.0	9.463	1.284	1.797	43.0	4.383	0.690	1.276
44.0	9.238	1.262	1.799	44.0	4.287	0.680	1.278
45.0	9.024	1.241	1.802	45.0	4.196	0.669	1.280
46.0	8.820	1.221	1.804	46.0	4.110	0.659	1.281
47.0	8.625	1.202	1.806	47.0	4.028	0.650	1.283
48.0	8.438	1.183	1.809	48.0	3.950	0.640	1.285
49.0	8.438	1.181	1.875	49.0	3.950	0.639	1.331
50.0	8.438	1.180	1.941	50.0	3.950	0.637	1.377
51.0	8.438	1.178	2.007	51.0	3.950	0.635	1.423
52.0	8.438	1.176	2.074	52.0	3.950	0.634	1.469
53.0	8.438	1.175	2.140	53.0	3.950	0.632	1.515
54.0	8.438	1.173	2.206	54.0	3.950	0.631	1.561
55.0	8.438	1.172	2.273	55.0	3.950	0.629	1.607
56.0	9.449	1.199	2.339	56.0	4.521	0.648	1.653
57.0	10.460	1.225	2.405	57.0	5.091	0.666	1.699
58.0	11.471	1.252	2.472	58.0	5.662	0.684	1.745
59.0	12.482	1.279	2.538	59.0	6.233	0.702	1.791
60.0	13.493	1.305	2.604	60.0	6.803	0.721	1.837
61.0	14.504	1.332	2.671	61.0	7.374	0.739	1.883
62.0	15.514	1.359	2.737	62.0	7.945	0.758	1.930
63.0	16.525	1.386	2.804	63.0	8.516	0.776	1.976
64.0	17.536	1.413	2.870	64.0	9.086	0.795	2.022
65.0	18.547	1.440	2.936	65.0	9.657	0.814	2.068
66.0	18.547	1.440	2.936	66.0	9.657	0.814	2.068
67.0	18.547	1.440	2.936	67.0	9.657	0.814	2.068
68.0	18.547	1.440	2.936	68.0	9.657	0.814	2.068
69.0	18.547	1.440	2.936	69.0	9.657	0.814	2.068
70.0	18.547	1.440	2.936	70.0	9.657	0.814	2.068
71.0	18.547	1.440	2.936	71.0	9.657	0.814	2.068
72.0	18.547	1.440	2.936	72.0	9.657	0.814	2.068
73.0	18.547	1.440	2.936	73.0	9.657	0.814	2.068
74.0	18.547	1.440	2.936	74.0	9.657	0.814	2.068
75.0	18.547	1.440	2.936	75.0	9.657	0.814	2.068

Bus Mobile 5A_H Emission Factors (1999 HDDV)

Speed	CO	VOC	NOX
2.5	37.454	4.821	19.096
3.0	35.932	4.696	18.679
4.0	33.115	4.458	17.893
5.0	30.575	4.237	17.163
6.0	28.281	4.029	16.487
7.0	26.207	3.836	15.860
8.0	24.329	3.654	15.279
9.0	22.627	3.485	14.740
10.0	21.082	3.326	14.240
11.0	19.679	3.177	13.776
12.0	18.402	3.038	13.347
13.0	17.240	2.907	12.949
14.0	16.180	2.784	12.581
15.0	15.213	2.669	12.241
16.0	14.331	2.561	11.927
17.0	13.523	2.459	11.637
18.0	12.785	2.364	11.371
19.0	12.109	2.274	11.127
20.0	11.489	2.190	10.903
21.0	10.922	2.110	10.699
22.0	10.401	2.035	10.514
23.0	9.923	1.965	10.346
24.0	9.484	1.899	10.196
25.0	9.081	1.836	10.062
26.0	8.711	1.777	9.944
27.0	8.371	1.722	9.842
28.0	8.060	1.670	9.754
29.0	7.774	1.621	9.681
30.0	7.511	1.574	9.622
31.0	7.271	1.530	9.577
32.0	7.052	1.489	9.545
33.0	6.851	1.451	9.528
34.0	6.668	1.414	9.524
35.0	6.502	1.380	9.533
36.0	6.352	1.347	9.556
37.0	6.217	1.317	9.593
38.0	6.095	1.288	9.643
39.0	5.987	1.261	9.708

40.0	5.891	1.236	9.787
41.0	5.807	1.212	9.880
42.0	5.735	1.190	9.989
43.0	5.675	1.169	10.113
44.0	5.625	1.150	10.253
45.0	5.586	1.132	10.410
46.0	5.557	1.115	10.584
47.0	5.538	1.099	10.777
48.0	5.529	1.085	10.989
49.0	5.531	1.072	11.220
50.0	5.542	1.059	11.473
51.0	5.564	1.048	11.749
52.0	5.596	1.038	12.048
53.0	5.639	1.029	12.372
54.0	5.692	1.021	12.723
55.0	5.756	1.014	13.102
56.0	5.831	1.008	13.512
57.0	5.918	1.002	13.955
58.0	6.018	0.998	14.432
59.0	6.130	0.994	14.947
60.0	6.255	0.992	15.503
61.0	6.395	0.990	16.102
62.0	6.550	0.989	16.748
63.0	6.721	0.989	17.444
64.0	6.909	0.990	18.196
65.0	7.115	0.992	19.006
66.0	7.115	0.992	19.006
67.0	7.115	0.992	19.006
68.0	7.115	0.992	19.006
69.0	7.115	0.992	19.006
70.0	7.115	0.992	19.006
71.0	7.115	0.992	19.006
72.0	7.115	0.992	19.006
73.0	7.115	0.992	19.006
74.0	7.115	0.992	19.006
75.0	7.115	0.992	19.006

M E M O R A N D U M

To: Lynda Mifsud (METRO)

From: David Ernst (KM Chng Environmental Inc.)

Date: 28 June 2000

Subject: Light Rail Downtown to Astrodome - Emissions Analysis Results

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KM Chng Environmental Inc. (or KM Chng) has evaluated the emissions effects of the proposed light rail line, based on the *Downtown to Astrodome Corridor Major Investment Study/Environmental Assessment* (MIS/EA) issued by METRO in August 1999. The MIS/EA estimated emissions reductions in the year 2020 due to the anticipated decrease in vehicle-miles traveled (VMT) with implementation of the light rail line (the primary forecast). The MIS/EA also discussed, but did not quantify, impacts of additional rail ridership due to a rail preference effect and impacts of reduced VMT due to induced development.

KM Chng estimated the emissions reductions expected for the primary forecast, rail preference, and induced development, for the SIP attainment year of 2007. The attached Table 1 summarizes the emissions results, and shows that the estimated total emission reductions from all three components are about 0.61 tons per day of nitrogen oxides (NOx) and 0.22 tons per day of volatile organic compounds (VOC). The complete analyses are contained in the files transmitted to you on 12/13/99 (as adjusted 2/14/00) for the primary forecast, 2/14/00 for rail preference, and 3/27/00 for induced development.

The change in emissions is calculated as the forecasted change in VMT times an emission factor (expressed in grams per VMT). Emission factors were calculated for the year 2007 using the U.S. Environmental Protection Agency MOBILE5a_h model with inputs provided by the Houston-Galveston Area Council (H-GAC). Emission rates for passenger vehicles (autos and light trucks) were calculated based on the regional vehicle mix provided by H-GAC, but excluding the commercial and heavy vehicle types. Buses were assigned emission factors for the MOBILE5a_h Heavy Duty Diesel Vehicle class.

Primary Forecast: Estimated VMT reductions were provided by Parsons Brinckerhoff Quade Douglas (PBQD), based on forecasted boardings data from the MIS/EA after adjustment to reflect 2007 levels. The forecasted VMT reductions for 2007 were 7,000,000 VMT per year for passenger vehicles and 1,770,000 VMT per year for buses. Average speeds in the corridor by vehicle type were used consistent with the MIS/EA. The resulting emission reductions were estimated to be 0.0832 tons per day of NOx and 0.0275 tons per day of VOC.

Rail Preference Effect: Rail preference refers to the observed finding that in cities having rail transit systems, people who have a choice between automobile and transit are more likely to use transit if the mode is rail than if the transit mode is a bus (MIS/EA, page 4-12). The MIS/EA did not account for a rail preference factor in the travel demand modeling for the primary forecast.

Table 4.8 in the MIS/EA gives the number of light rail boardings as 33,132 for the primary forecast and an additional 3,127 for rail preference. The number of boardings due to rail preference is about 9.4% (i.e., 3,127/33,132) of the primary forecast. VMT reduction was assumed to occur at the same rate for the rail preference effect as for the primary forecast. Therefore, the additional emission reduction due to rail preference was calculated as the same fraction (9.4%) of the previously estimated emission reductions for the primary forecast. The resulting estimated emission reductions are 0.0079 tons per day of NOx, and 0.0026 tons per day of VOC.

Induced Development: Induced development refers to the potential for new development attracted by the presence of light rail stations. This development would have occurred somewhere in the Houston region in any case, but the presence of light rail was forecasted to attract a larger share of regional growth to the vicinity of the rail stations. The MIS/EA did not account for either rail preference effects or induced development in the travel demand modeling for the primary forecast.

Induced development is expected to lead to emission reductions because the travel characteristics of the population (residents) and employment (jobs) change when they locate in the light rail corridor instead of locating generally in the 8-county region. Trips by the corridor population and employees would be expected to have shorter distances, lower speeds, lower auto mode shares, and higher auto occupancy rates, relative to trips in the region generally. The emissions from these trips would reflect these differences.

PBQD provided travel data for the households and employment in the light rail corridor. Travel characteristics for the region were taken from data sources previously provided by METRO. The VMT reduction due to changes in travel characteristics with induced development was calculated taking into account the average trip distances, speeds, mode shares, and auto occupancy rates for travel in the corridor versus travel in the region. The estimated VMT reduction in 2007 due to induced development is 363,976 VMT per day. Using passenger vehicle emission factors for the average speeds in the corridor and the region, the estimated emission reductions due to induced development are 0.5164 tons per day of NOx, and 0.1942 tons per day of VOC.

Summary of Light Rail Emissions Reductions: The total estimated NOx and VOC reductions with light rail in 2007, based on the analysis above and assuming that all components are additive and do not interact, are given in Table 1.

Table 1

Summary of Estimated Emissions Reductions with Light Rail in 2007

Light Rail Impact Component	Emissions Reduction (tons/day)	
	NOx	VOC
Primary Forecast	0.0832	0.0276
Rail Preference Effect	0.0079	0.0026
Induced Development	0.5164	0.1942
Total	0.6075	0.2244

2022 MTP: TCM PROJECTS WITH OFF MODEL CREDIT TAKEN IN YEARS 2000 OR 2007

(Sorted by Lead Agency)

PROJ ID	PROJ NUM	CO	STREET	FROM LOCATION	TO LOCATION	PROJECT DESCRIPTION	LEAD AGENCY	PROJ STATUS	EST. COMPLET	TOTAL VOC REDUCED (lbs/day)	TOTAL NOX REDUCED (lbs/day)	TOTAL COST
4069	1996-0757- -XX	MON	THE WOODLANDS	LAKE ROBBINS	GROGANS MILL RD	CONSTRUCT PEDESTRIAN SYSTEM, CONNECTIONS &	**BRAZOS TRANSIT**	S	9/7/00	0.1029	0.1686	$3,500,000
9978	1999-0007- -00	MON	VA	WOODLANDS TOWN CENTER	GORGAN'S MILL	PURCHASE 6 SMALL ALT FUELED VEHICLES	**BRAZOS TRANSIT**	T	8/31/02	20	31	$1,800,000
5097	T96051-98	MON	UNK			PROVIDE OPERATION OF 6 ADDT'L BUSES TO SERVE RESEARCH FOREST P&R	**BRAZOS TRANSIT**	LET	5/1/99	20	31	$600,000
5098	T96052-XX	MON	UNK			PROVIDE OPERATION OF 6 ADDT'L BUSES TO SERVE RESEARCH FOREST P&R	**BRAZOS TRANSIT**	S	9/30/07	20	31	$600,000
2927	HOU.BO.332	BRA	ALVIN MUSTANG TRL	N ALVIN CITY LIMIT	S ALVIN CITY LIMIT	CONST ALVIN MUSTANG TRL SYS OF BRA CO	**CITY OF ALVIN**	T	9/30/07	0.1715	0.281	$998,400
5053	1996-0722- -00	HAR	GOOSE CREEK TRAIL	W TEXAS AVE	GARTH RD	CONST HIKE/BIKE TRAIL ALONG GOOSE CREEK (PHASE 4)	**CITY OF BAYTOWN**	T	8/1/04	0.1921	0.3148	$1,361,919
3069	HO.HR.0154B	HAR	GOOSE CREEK	ARIZONA ST	DECKER DRIVE	CONST HIKE & BIKE TRAIL	**CITY OF BAYTOWN**	T	5/1/02	0.1329	0.2178	$1,218,614
9954	HO.HR.0154C	HAR	VA	GOOSE CREEK TRAIL FROM S OF W TEXAS AVE	W TEXAS AVE	CONSTRUCT HIKE/BIKE TRAIL SUPPLEMENTAL FUNDING TO ENHANCEMENT PROJECT	**CITY OF BAYTOWN**	T	5/1/02	0.1329	0.2178	$806,250
5052	1999-0012- -00	MON	FM 2854	IH 45 @ FM 2854	W LOOP 336 @ IH 45	CONST BIKE LNS & ON-STREET BIKE LNS // ADD STRIPPING FOR ON-STREET BIKE LANE	**CITY OF CONROE**	T	8/1/04	0.4802	0.7869	$366,231
3063	1995-0044-A-00	HAR	W HOUSTON ON-ST BIKEWAY - PH			BIKE W HOUSTON ON-ST BIKEWAY - PH 1 (TCM SIP	**CITY OF HOUSTON**	LET	11/1/00	3.5202	5.7691	$1,220,000
6085	1995-0044-B-00	HAR	VA	W HOUSTON ON-ST BIKEWAY	PHASE 2	BIKE W HOUSTON ON-ST BIKEWAY - PH 2 (TCM SIP	**CITY OF HOUSTON**	T	3/1/02	0.2089	0.3424	$601,000
3064	1995-0045- -00	HAR	BUFFALO BAYOU TRAIL	SHEPHERD DR	SABINE	BIKE TRL ON BUFFALO BAYOU PARALLEL TO MEMORIAL DR & ALLEN PKWY(TCM SIP	**CITY OF HOUSTON**	T	3/1/04	0.6416	1.0515	$2,820,050
5022	1995-0047- -00	HAR	BRAYS BAYOU TRAIL	DAIRY ASHFORD	BEECHNUT	CONST BIKE/HIKE TRAIL	**CITY OF HOUSTON**	T	9/30/07	0.4973	0.815	$2,696,000
3065	1995-0049- -98	HAR	HERMAN BROWN PARK TRL - PH 1	W/I HERMAN BROWN PARK	DUNVEGAN WAY AT MERCURY DR & WESTSHIRE AT IH 10	BIKE & HIKE TRL THROUGH HERMAN BROWN PARK (TCM SIP COMMITMENT)	**CITY OF HOUSTON**	LET	9/1/00	0.0913	0.1496	$611,000
9841	1995-0049-A-00	HAR	HERMAN BROWN PARK TRL - PH 2	W/I HERMAN BROWN PARK	EAST TO FM 526 & SOUTH TO IH	BIKE & HIKE TRL THROUGH HERMAN BROWN PRK (TCM SIP	**CITY OF HOUSTON**	T	6/1/02	0.0913	0.1496	$932,000
3066	1995-0050- -00	HAR	HOU HRTGE COR PROJ: PH IA - BAYOU BKWAYS	HOU AVE ON W	LOCKWOOD DR ON E	BIKE BAYOU BIKEWAY - PHASE IA (PORT TO PORT: HOUSTON HERITAGE PROJECT) (TCM SIP COMMITMENT)	**CITY OF HOUSTON**	T	3/1/04	0.1594	0.2612	$6,830,212
2986	1996-0447- -	HAR	WESTHEIMER	@ WILCREST		INTERSECTION IMPROVEMENTS	**CITY OF HOUSTON**	LET	9/30/07	4.02	1.25	$150,000
5050	1996-0719- -XX	HAR	WHITE OAK/KATY RAIL	14TH ST	MAIN ST	BIKE TRAIL/LANE ON RDS & RR ROW	**CITY OF HOUSTON**	L	9/30/07	0.5316	0.8712	$2,136,000
9351	1996-0786- -00	HAR	KEEGANS BAYOU TRL	BRAYS BAYOU TRL-GESSNER	CITY LIMITS NEAR SYNOT	CONST HIKE & BIKE	**CITY OF HOUSTON**	T	9/30/07	0.7215	1.1824	$4,375,000
9358	1996-0793- -XX	HAR	OLD GALVESTON RD BIKEWAY	ALLENDALE	BAY AREA BLVD	CONSTRUCT HIKE/BIKE TRAIL	**CITY OF HOUSTON**	TLOC	9/30/07	1.2907	2.1153	$237,500
3072	HO.HR.0187	HAR	EAST BRAYS BAYOU TRAIL - WEST	DIXIE BRIDGE NEAR HERMAN PARK	MASON PARK AT TIPPS ST	UPGRADE EXISTING HIKE AND BIKE; IMPROVE CONNECTIONS TO PROPOSED ON-STREET BIKEWAYS, ADD SIGNAGE(TCM	**CITY OF HOUSTON**	T	9/1/03	0.4474	0.7333	$4,889,000
9870	HO.HR.0188A	HAR	WEST BRAYS BAYOU TRL-EAST SEGMENT	1500' W OF I 610(WEST LOOP)	MIDWAY IN HERMANN PARK	CONST BIKE TRAIL (TCM SIP COMMITMENT)	**CITY OF HOUSTON**	T	9/1/02	0.6075	0.9955	$3,773,152

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9902	HO.HR.0188B	HAR	WEST BRAYS BAYOU TRL-WEST SEG A	550' N OF BISSONNET	1500' W OF IH 610 (WEST LOOP)	CONST WEST BRAYS BAYOU BIKE TRAIL (TCM SIP COMMITMENT)	**CITY OF HOUSTON**	T	10/1/02	0.5255	0.8612	$1,925,050
9903	HO.HR.0188C	HAR	WEST BRAYS BAYOU TRL-WEST SEG B	BEECHNUT	550' N OF BISSONNET	CONST WEST BRAYS BAYOU BIKE TRAIL (TCM SIP COMMITMENT)	**CITY OF HOUSTON**	T	12/1/02	0.2714	0.4448	$459,775
2931	HOU.HR.305- -00	HAR	SIMS BAYOU TRAIL	ROSENHAVEN ST	@ SCOTTCREST PARK TO IH 45	CONSTRUCT SIMS BAYOU TRAIL	**CITY OF HOUSTON**	TLOC	9/30/07	0.2786	0.4566	$1,296,000
2930	HOU.HR.306-00	HAR	COLUMBIA TAP RAIL TO TRAIL	DIXIE	POLK ST	CONST COLUMBIA TAP RAIL TO TRAIL BIKE PATH	**CITY OF HOUSTON**	T	9/30/07	0.0475	0.0779	$2,293,358
2929	HOU.HR.307	HAR	W WHITE OAK BAYOU TRL EXT	S OF PINEMONT ALONG WHITE OAK BAYOU	TO W LITTLE YORK, DERRIEST	CONST EXTENSION OF BIKE TRL	**CITY OF HOUSTON**	T	9/30/07	0.126	0.2065	$2,252,904
2795	HRBR01	HAR	HALLS BAYOU			PAVE	**CITY OF HOUSTON**	S	9/30/07	1.449	2.3748	$3,880,000
9987	HO.HR.0181A	HAR	CBD ACCESS ON-STREET	NORTH SEGMENT		CBD ACCESS ON-STREET BIKEWAY NETWORK (TCM SIP	**CITY OF HOUSTON/TXDOT**	LET	6/1/01	1.3705	2.246	$2,076,965
9988	HO.HR.0181B	HAR	CBD ACCESS ON-STREET	SOUTH SEGMENT - PH 1		CBD ACCESS ON-STREET BIKEWAY NETWORK (TCM SIP	**CITY OF HOUSTON/TXDOT**	LET	12/1/00	2.3415	3.8373	$1,282,474
9989	HO.HR.0181C	HAR	CBD ACCESS ON-STREET	SOUTH SEGMENT - PH 2		CBD ACCESS ON-STREET BIKEWAY NETWORK (TCM SIP	**CITY OF HOUSTON/TXDOT**	T	3/1/02	0.2208	0.3618	$156,600
3071	HO.HR.0182A	HAR	TMC/GREENWAY PLAZA/GALLERIA ON-ST BIKE			MED CTR/GREENWAY PLAZA/GALLERIA ACCESS ON-STREET BIKEWAY NETWORK-EAST SEG PH 1 (TCM SIP	**CITY OF HOUSTON/TXDOT**	LET	9/1/01	2.9581	4.8479	$1,277,400
7003	HO.HR.0182B	HAR	TMC/GREENWAY PLAZA/GALLERIA ON-ST BIKE			TMC/GREENWAY PLAZA/GALLERIA ACCESS ON-STREET BIKEWAY NETWORK - NORTH SEGMENT PH 1 (TCM SIP	**CITY OF HOUSTON/TXDOT**	LET	12/1/00	0.7243	1.1871	$440,000
7004	HO.HR.0182C	HAR	TMC/GREENWAY PLAZA/GALLERIA ON-ST BIKE			TMC/GREENWAY PLAZA/GALLERIA ACCESS ON-STREET BIKEWAY NETWORK - WEST SEGMENT PH 1 (TCM SIP	**CITY OF HOUSTON/TXDOT**	LET	10/1/01	4.1216	6.7547	$1,734,700
7005	HO.HR.0182D	HAR	TMC/GREENWAY PLAZA/GALLERIA ON-ST BIKE			TMC/GREENWAY PLAZA/GALLERIA ACCESS ON-STREET BIKEWAY NETWORK-PH 2 (TCM SIP COMMITMENT)	**CITY OF HOUSTON/TXDOT**	T	3/1/02	1.2676	2.0774	$1,661,900
3074	HO.HR.0189	HAR	W WHITE OAK BAYOU TRAIL	11TH ST	S OF PINEMONT	CONSTRUCT W WHITE OAK BAYOU TRAIL (TCM SIP	**CITY OF HOUSTON/TXDOT**	LET	9/1/00	0.2556	0.4188	$2,602,000
3075	HO.HR.0192A	HAR	HARRISBURG/SUNSET RAILS TO	CHENEVERT	75TH STREET AND BUFFALO	HARRISBURG/SUNSET RAILS TO TRAILS-PH 1 (TCM SIP	**CITY OF HOUSTON/TXDOT**	LET	6/1/00	0.2612	0.428	$2,075,000
7006	HO.HR.0192B	HAR	HARRISBURG/SUNSET RAILS TO			HARRISBURG/SUNSET RAILS TO TRAILS-PH 2 (TCM SIP	**CITY OF HOUSTON/TXDOT**	T	3/1/02	0.1019	0.167	$952,000
2221	1996-0132- -XX	GAL	BRITTANY BAY	IH 45	BAY AREA BLVD	CONST HIKE & BIKE	**CITY OF LEAGUE CITY**	S	9/30/07	0.2049	0.3358	$324,000
2222	1996-0133- -XX	GAL	BRITTANY BAY	BAY AREA BLVD	FM 528	CONST HIKE & BIKE	**CITY OF LEAGUE CITY**	S	9/30/07	0.4056	0.6647	$600,000
2223	1996-0134- -XX	GAL	BAY AREA BLVD	BRITTANY BAY	S END OF CLEAR CRK	CONST HIKE & BIKE	**CITY OF LEAGUE CITY**	S	9/30/07	0.1218	0.1995	$192,000
5056	1996-0725- -00	GAL	SH 96	IH 45	FM 1266	CONST HIKE/BIKE TRAIL ALONG	**CITY OF LEAGUE CITY**	T	9/30/07	0.4073	0.6675	$757,500
5057	1996-0726- -XX	GAL	FM 518	PERKINS	ILLINOIS	CONST PED SIDEWALK ALONG FM 518	**CITY OF LEAGUE CITY**	S	9/30/07	0.0514	0.0843	$425,000
2918	T96007-XX	GAL	SH 96	@ IH 45		CONSTRUCT PARK & RIDE (472 SPACES)	**CITY OF LEAGUE CITY**	S	9/30/07	9	15	$300,000
2269	1996-0190- -XX	FOR	FM 1092			RESTRIPPING BIKE LN & SIDEWALK	**CITY OF MISSOURI CITY**	S	9/30/07	0.2435	0.3991	$207,833
2270	1996-0191- -XX	FOR	FM 2234			RESTRIPPING BIKE LN & SIDEWALK	**CITY OF MISSOURI CITY**	S	9/30/07	0.2915	0.4778	$248,814
2273	1996-0194- -XX	FOR	TR #1 - #11			CONST HIKE & BIKE TRAIL	**CITY OF MISSOURI CITY**	S	9/30/07	0.0969	0.1588	$2,376,000
2281	1996-0202- -XX	FOR	TR #12 - #21			CONST HIKE & BIKE TRAIL	**CITY OF MISSOURI CITY**	S	9/30/07	0.0406	0.0665	$2,397,600
5054	1996-0723- -XX	FOR	SEG 1: HIKE/BIKE TRAIL	CITY HALL/CIVIC CNTR	COMMUNITY PARK	CONST HIKE/BIKE TRAIL	**CITY OF MISSOURI CITY**	S	9/30/07	0.367	0.6014	$2,795,600

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5055	1996-0724- -XX	FOR	SEG 3: HIKE/BIKE TRAIL	FONDREN PARK	CITY HALL/CIVIC CNTR	CONST HIKE/BIKE TRAIL	**CITY OF MISSOURI CITY**	S	9/30/07	0.4313	0.7068	$3,004,400
2928	HOU.FB.303-00	FOR	SEG 2: MISSOURI CITY BIKE TRL	COURT RD	CARTWRIGHT RD	CONST HIKE & BIKE TRL	**CITY OF MISSOURI CITY**	T	9/30/07	0.5813	0.9527	$173,956
2969	1996-0455- -00	BRA	MAGNOLIA DR	@ BNSF RR		CONSTRUCT GSEP @ RR TRACK	**CITY OF PEARLAND**	T	9/30/07	0.5	0.14	$1,500,000
5051	1996-0720- -	BRA	FM 518	WESTMINISTER	RIVERSIDE DR	CONST SIDEWALK/BIKE PATH	**CITY OF PEARLAND**	S	9/30/07	0.2829	0.4637	$321,727
5058	1996-0727- -00	FOR	SH 36	US 59	US 90A	CONST PED SIDEWALK ALONG	**CITY OF**	T	9/30/07	0.1458	0.2389	$150,000
1117	1996-0100- -00	FOR	WILLIAMS TRACE BLVD	US 59	SH 6	SIGNALIZATION, SYNCHRONIZATION &	**CITY OF SUGAR LAND**	T	9/30/07	0.0048	0.0000001	$265,000
1118	1996-0101- -00	FOR	WILLIAMS TRACE BLVD	SH 6	AUSTIN PKWY	SIGNALIZATION, SYNCHRONIZATION &	**CITY OF SUGAR LAND**	T	9/30/07	0.006	0.0000002	$215,000
1119	1996-0102- -	FOR	SH 6	US 59	BROOKS ST	SYNCHRNZTN & INTRCNNTN	**CITY OF SUGAR**	TLOC	9/30/07	0.00382	0.0000001	$50,000
1120	1996-0103- -	FOR	SH 6	LEXINGTON BLVD	AUSTIN PKWY	SYNCHRNZTN & INTRCNNTN	**CITY OF SUGAR**	TLOC	9/30/07	0.00322	0.0000001	$150,000
1121	1996-0104- -00	FOR	LEXINGTON BLVD	DULLES AVE	SH 6	INSTALL ATMS: SIGNLZTN, SYNCHRNZTN & INTRCNNTN	**CITY OF SUGAR LAND**	T	9/30/07	0.00284	0.0000001	$360,000
1122	1996-0105- -00	FOR	AUSTIN PKWY	LEXINGTON	SH 6	INSTALL ATMS	**CITY OF SUGAR**	T	9/30/07	0.25	0.05	$780,000
1123	1996-0106- -00	FOR	SWEETWATER BLVD	LEXINGTON BLVD	AUSTIN PKWY	INSTALL ATMS: SIGNLZTN, SYNCHRNZTN & INTRCNNTN	**CITY OF SUGAR LAND**	T	9/30/07	0.00277	0.0000002	$410,000
1124	1996-0107- -	FOR	DULLES AVE	SH 6	US 90A	SYNCHRNZTN & INTRCNNTN	**CITY OF SUGAR**	TLOC	9/30/07	0.00526	0.0000001	$285,000
5060	1996-0729- -XX	FOR	WILLIAMS TRACE BLVD	@ OYSTER CREEK		CONST BIKE/PED BRIDGE OVER OYSTER CREEK	**CITY OF SUGAR LAND**	L	9/30/07	0.0043	0.007	$234,000
5061	1996-0730- -XX	FOR	SWEETWATER BLVD	@ DITCH "A"		CONST BIKE/PED BRIDGE OVER "DITCH A"	**CITY OF SUGAR LAND**	L	9/30/07	0.0034	0.0056	$207,600
3039	T96013A-00	FOR	SH 36 - FAIRGROUNDS P&R	@ US 59		PH 1-CONDUCT PE FOR FAIRGROUNDS PARK & RIDE (250 SPACES)	**FORT BEND COUNTY**	T	9/30/07	5	8	$62,500
9756	T96013B-00	FOR	SH 36 - FAIRGROUNDS	@ US 59		PH 2-CONSTRUCT FAIRGROUNDS PARK & RIDE	**FORT BEND COUNTY**	T	9/30/07	5	8	$430,860
9390	T96003B-00	GAL	IH 45 S	@ FM 1764		PH 2 - FINAL DESIGN & CONST OF GAL CO PARK & RIDE	**GULF COAST CENTER**	T	8/1/01	10	16	$2,483,000
9401	T96004B-00	BRA	VA	VARIOUS		PH 2-CONST BRA CO OP/MAINTENANCE FACILITY WITH PARK & RIDE * CONTINGUENT UPON RESULTS	**GULF COAST CENTER**	T	8/1/01	5	8	$2,200,000
4090	T96047-00	BRA	VA	VARIOUS LIMITS		PH 2-PARK & RIDE SERVICES (FY 99) *FUNDING CONTINGUENT UPON RESULTS OF PH 1	**GULF COAST CENTER**	T	8/1/05	10	16	$400,000
4091	T96048-XX	BRA	UNK			PH 2-PARK & RIDE SERVICES (FY 00) *FUNDING CONTINGUENT UPON RESULTS OF PH 1	**GULF COAST CENTER**	S	8/1/07	5	8	$420,000
2934	HOU.HR.317	HAR	NORTH CHANNEL HIKE & BIKE TRL	WOODFOREST BLVD (SOUTH)	WALLISVILLE RD (NORTH)	CONST HIKE & BIKE TRL (HARRIS CO. PCT2)	**HARRIS COUNTY**	T	9/30/07	0.0643	0.1054	$787,415
6070	1999-0263- -00	HAR	FAIRMONT PKWY	AT SP RR		CONSTRUCT GSEP	**HARRIS COUNTY**	T	9/30/07	0.77	0.24	$5,000,000

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2207	1996-0109- -98	HAR	UNK			REGIONAL COMMUTE ALTERNATIVES PROG - FY 99	**H-GAC**	LET	9/30/07	70.57	171.91	$1,708,750
3048	1996-0520-A-98	VA	VA			REGIONAL VANPOOL PROGRAM - FY 99	**H-GAC**	LET	9/30/07	70.57	171.91	$1,387,500
9417	1996-0520-B-00	VA	VA			REGIONAL VANPOOL PROGRAM - FY 00	**H-GAC**	LET	9/30/07	62.83	163.52	$1,387,500
6001	1996-0520-C-XX	VA	VA			REGIONAL VANPOOL PROGRAM FY 01 - 07	**H-GAC**	S	9/30/07	62.83	163.52	$9,710,680
3049	1996-0521-A-98	VA	VA			TELECOMMUTING 3 YR PILOT PROGRAM (FY 98-00)	**H-GAC**	LET	9/30/07	466	658.5	$358,845
6000	1996-0521-D-XX	VA	VA			TELECOMMUTING PROGRAM FY 01 - 07	**H-GAC**	S	9/30/07	466	658.5	$837,305
9927	1999-0131- -00	HAR	VA	VARIOUS		FY 2000 REGIONAL COMMUTE ALTERNATIVES PROGRAM IMPLEMENTATION	**H-GAC**	LET	9/30/07	62.83	163.52	$3,439,040
9945	1999-0133-A-00	HAR	VA	VARIOUS		FY 2001 REGIONAL COMMUTE ALTERNATIVES PROGRAM IMPLEMENTATION	**H-GAC**	T	9/30/07	62.83	163.52	$5,049,090
9975	1999-0136- -00	HAR	VA	VARIOUS		FY 2002 REGIONAL COMMUTE ALTERNATIVES PGM IMPLEMENTATION (80%)	**H-GAC**	T	9/30/07	62.83	163.52	$4,177,187
1532	1994-0080-C-98	HAR	VA	8-COUNTY NON-ATTAINMENT		REGIONAL VANPOOL PROGRAM TO SUPPORT ETR (QUICK START-	**H-GAC**	LET	9/30/07	70.57	171.91	$980,000
9790	1995-0207-D-98	HAR	VA	VARIOUS LIMITS		FY 98 REGIONAL COMMUTE ALTERNATIVES	**H-GAC**	LET	9/30/07	70.57	171.91	$1,250,000
						REGIONAL RCTSS PROGRAM (INCLUDES PROJS PROGRAMMED IN 2000 TIP AND THOSE IN SR TO BE	**TXDOT/METRO/CITY OF HOUSTON/HARRIS CO**	T/S	9/30/07	6329.35	1494.6	$150,436,900
3092	1996-0855- -00	MON	WOODLANDS PKWY	IH 45	COCHRANS CROSSING	SIGNAL SYNCHRONIZATION	**MONTGOMERY COUNTY**	T	6/30/01	0.00393	0.0000001	$215,400
3090	1996-0856- -00	MON	RESEARCH FOREST	IH 45	KUYKENDAHL	SIGNAL SYNCHRONIZATION	**MONTGOMERY COUNTY**	T	6/30/01	0.00148	0	$167,000
3091	1996-0858- -XX	MON	SAWDUST/GROGAN'S MILL	IH 45	WOODLANDS PKWY	ATMS: SIGNAL SYNCHRONIZATION	**MONTGOMERY COUNTY**	S	7/31/05	0.01027	0.0000003	$215,400
3089	1996-0857- -XX	MON	LAKE WOODLANDS	IH 45	GOSLING	ATMS: SIGNAL SYNCHRONIZATION	**MONTGOMERY COUNTY**	S	8/1/04	0.00615	0.0000002	$118,600
9534	1995-0220-B-00	HAR	DEER PARK JUNCTION TERMINAL	AT STRANG YARD		CONSTRUCT PORT OF HOUSTON LEAD TRACK - SEGMENT 3 AT STRANG YARD	**PORT OF HOUSTON AUTHORITY**	LET	8/31/01	6.682	31.38	$14,882,830
2445	1996-0432-A-00	HAR	BARBOURS CUT QUEUE LNS			CONSTRUCT QUE LANES ALONG GEORGE ALTVATER RD /TRAFFC CROSSOVERS	**PORT OF HOUSTON AUTHORITY**	T	9/30/03	6.682	31.138	$2,750,000
7104	1996-0432-B-00	HAR	BARBOURS CUT TERMINAL			CONSTRUCT ADDITIONAL RAIL TO BARBOURS CUT TERMINAL	**PORT OF HOUSTON AUTHORITY**	T	9/30/03	6.682	31.138	$850,000
2982	1996-0433-A-00	HAR	TRANSFER STA @ INDSTRL			CONSTRUCT 8900 FT OF RAILROAD TRACK (PH 1)	**PORT OF HOUSTON AUTHORITY**	T	8/31/03	6.682	31.138	$4,625,000
9371	1996-0433-C-XX	HAR	TRANSFER STA @ INDSTRL			EXTEND RAILROAD TRACK FOR SHIPSIDE SERVICE (PH 3)	**PORT OF HOUSTON AUTHORITY**	S	9/30/03	6.682	31.138	$3,362,500
3095	1996-0699- -00	HAR	DEER PRK/PASADENA JUNCTION RAIL	DEER PARK JUNCTION	PASADENA JUNCTION	CONSTRUCT ADDT'L TRACK TO PASADENA JUNCTION	**PORT OF HOUSTON AUTHORITY**	T	9/30/03	6.682	31.138	$5,750,000
1007	1993-0523-B-	HAR	IH 10 W	STUDEMONT	SAN JACINTO	INSTALL CTMS	**TXDOT**	T	9/30/07	32.6	8.5	$1,255,000

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1071	1994-0244-B-98	FOR	US 59 SW	W OF S KIRKWOOD	RAMPS AT SP 41/SUGAR CRK BLVD	UPGRADE FIXED TIME TO ACTUATED SIGNALS	**TXDOT**	LET	8/31/03	0.00338	0.0000001	$40,000
1072	1994-0244-C-98	FOR	US 59 SW	RAMPS AT SPUR 41/SUGAR	SH 6	UPGRADE FIXED TIME TO ACTUATED SIGNALS	**TXDOT**	LET	8/31/03	0.005	0.0000001	$150,000
9846	1994-0254-A-98	HAR	FM 529	HUFFMEISTER RD	BARKER-CYPRESS RD	INSTALL ATMS	**TXDOT**	LET	8/31/01	0.85	0.2	$393,513
1027	1994-0264- -00	HAR	US 59 SW	W BELLFORT	FOR C/L	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	6.6	1.72	$318,000
1008	1994-0266-A-00	HAR	IH 10	MEADOW ST	SP 330	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	8/31/02	95.17	24.81	$6,177,062
9527	1994-0266-A-00	HAR	IH 10 E	SAN JACINTO ST	MEADOW ST	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	17.97	4.68	$600,000
1026	1994-0267- -00	HAR	SP 330	IH 10	LP 201 (SH 146)	INSTALL CTMS	**TXDOT**	T	9/30/07	69.25	18.05	$3,483,000
1020	1994-0271- -00	BRA	SH 35	14TH ST	SH 36	INSTALL ATMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	0.34	0.07	$178,000
1062	1994-0378- -XX	BRA	SH 35	@ MUSTANG RD & @ FM 1459		ADD LTLS	**TXDOT**	S	9/30/07	3.33	0.91	$140,000
206	1994-0379- -00	HAR	US 290	@ MASON RD		CONSTRUCT GSEP	**TXDOT**	LET	9/30/07	1.09	0.34	$8,500,000
1023	1994-0386- -00	GAL	SH 6	FM 2004	FM 519	INSTALL ATMS	**TXDOT**	LET	8/31/01	0.52	0.11	$183,000
1011	1994-0692- -00	GAL	IH 45 S	W OF 59TH ST	61ST ST	INSTALL ATMS	**TXDOT**	T		0.58	0.14	$65,000
1012	1995-0163- -00	GAL	IH 45 S	61ST ST	S OF SH 6	CTMS (TV CIRCUIT & VEH DETECTION SYS)	**TXDOT**	LET	8/31/02	19.88	5.09	$3,856,000
1028	1995-0164- -98	HAR	US 59 NE	0.28 MI N OF SAUNDERS	IH 610	INSTALL CTMS	**TXDOT**	LET	8/31/04	87.23	22.74	$1,082,654
9533	1995-0164-A-00	HAR	US 59 SW	IH 610	0.019 MI N OF BELL ST	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	144.75	37.73	$2,780,000
1013	1995-0165- -00	MON	IH 45 N	N OF CRIGHTON RD	LP 336 N	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	17.22	4.41	$2,610,000
1029	1995-0169- -00	HAR	US 59 NE	FM 1960	MON C/L	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	21.66	5.65	$1,783,000
1014	1995-0170- -00	HAR	IH 45 N	RANKIN RD	CYPRESSWOOD	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	8/31/01	95.67	24.94	$3,596,000
1825	1995-0170-A-00	HAR	IH 45 N	CYPRESSWOOD	MON C/L	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	33.76	8.8	$2,409,000
1030	1995-0171- -00	HAR	US 59 SW	BELL ST	S SHEPHERD	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	50.23	13.09	$2,162,000
1015	1995-0175- -00	MON	IH 45 N	HAR C/L	TAMINA RD	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	77.79	19.9	$2,889,000
9536	1995-0175-A-00	MON	IH 45 N	TAMINA RD	0.966 KM N OF CRIGHTON RD	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	30.3	7.75	$3,956,000
1031	1995-0176- -00	FOR	US 59 SW	0.4235 MI W OF S KIRKWOOD DR	SH 6	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	29.74	7.61	$2,800,000
1032	1995-0178- -98	HAR	US 59 NE	GREENS BAYOU	0.28 MI N OF SAUNDERS	INSTALL CTMS	**TXDOT**	LET	8/31/01	54.18	14.12	$3,027,731
9532	1995-0178-A-98	HAR	US 59 NE	0.136 MI S OF BF 1960A	GREENS BAYOU	INSTALL CTMS	**TXDOT**	LET	8/31/01	43.63	11.37	$2,172,654
1019	1995-0179- -00	HAR	SH 249	WESTLOCK	BW 8	INSTALL CTMS (TCM SIP COMMITMENT)	**TXDOT**	T	9/30/07	45.46	11.85	$4,540,000
1016	1995-0180- -00	GAL	IH 45 S	S OF SH 6	HAR C/L	INSTALL CTMS	**TXDOT**	LET	8/31/02	31.6	8.08	$10,345,000
1144	1996-0255- -00	HAR	BU 90-U	IH 610 E	BW 8 E	ADD CLT LN W/ C&G	**TXDOT**	T	9/30/07	0.24	0.08	$2,500,000
470	1996-0256- -XX	HAR	IH 45 S	@ EL DORADO		CONSTRUCT EBOUND BRIDGE	**TXDOT**	S	9/30/07	2.05	0.64	$2,000,000
2971	1996-0258- -XX	HAR	BW 8 E	PASADENA BLVD	RED BLUFF RD	IMPROVE INTERSECTION PROFILE - TURNING RADIUSES &	**TXDOT**	T	9/30/07	0.87	0.24	$1,000,000
2996	1996-0457- -XX	GAL	FM 1764	@ AMBURN		CONSTRUCT RIGHT TRN LANES	**TXDOT**	S	9/30/07	1.3	0.36	$121,719
2999	1996-0460- -98	FOR	FM 2234	@ FM 521		CONSTRUCT ADDT'L TRN LANES @ INTERSECTION	**TXDOT**	LET	8/31/00	4.12	1.13	$1,200,000
3000	1996-0461- -98	FOR	FM 359	@ US 90A		CONSTRUCT ADDT'L TURN LANES @ INTERSECTION	**TXDOT**	LET	8/31/99	4.12	1.13	$352,748
3006	1996-0467- -98	MON	IH 45 N	@ FM 1097		IMPROVE INTERSECTION & WIDEN BRIDGE	**TXDOT**	LET	8/31/00	2.79	0.76	$2,000,000
3007	1996-0468- -98	HAR	IH 610	@ N SHEPHERD, N DURHAM AND ELLA BLVD		CONSTRUCT U-TURNS	**TXDOT**	LET	8/31/00	1.94	0.61	$680,000
3009	1996-0470- -98	GAL	SH 146	@ EDGEWATER & LP 197 N		CONSTRUCT RIGHT TURN LANES	**TXDOT**	LET	8/31/99	0.81	0.22	$243,671
3010	1996-0471- -00	HAR	SH 225	SH 134	STRANG RD	INSTALL CTMS	**TXDOT**	LET	8/31/02	3.88	1.01	$2,270,000

T=2000 TIP (yrs 00-02); S=Short-range (yrs 03-07); L=Long-range (yrs 08-22); TLOC=Locally Funded; LET=Implementation in progress

2022 MTP: TCM PROJECTS WITH OFF MODEL CREDIT TAKEN IN YEARS 2000 OR 2007

(Sorted by Lead Agency)

PROJ ID	PROJ NUM	CO	STREET	FROM LOCATION	TO LOCATION	PROJECT DESCRIPTION	LEAD AGENCY	PROJ STATUS	EST. COMPLET	TOTAL VOC REDUCED (lbs/day)	TOTAL NOX REDUCED (lbs/day)	TOTAL COST
3012	1996-0473- -XX	BRA	SH 288	@ CR 44		CONSTRUCT GSEP OF M/L OVER CR 44	**TXDOT**	L	9/30/07	0.7	0.19	$6,200,000
3013	1996-0474- -	BRA	SH 288	@ FM 2004		CONSTRUCT GSEP	**TXDOT**	S	9/30/07	0.83	0.23	$3,884,000
3017	1996-0478- -	FOR	US 59 SW	@ SP 10		CONSTRUCT GSEP	**TXDOT**	S	9/30/07	0.73	0.2	$4,000,000
2993	1996-0485- -00	HAR	BW 8	AT WESTHEIMER RD & RICHMOND		ADD RIGHT TRN LNS AT INTERSECTIONS NBOUND	**TXDOT**	T	9/30/07	1.46	0.46	$500,000
2995	1996-0487- -98	GAL	FM 1764	@ SH 146		CONSTRUCT RIGHT TURN LN	**TXDOT**	LET	8/31/00	0.56	0.15	$78,951
1103	1996-0650- -00	HAR	SH 146	MCCABE RD	TYLER ST	INSTALL CTMS - INCL SURVELLANCE SYS, COMMUNICATN SYS, SATELLITE COMPUTER FAC. & MONITORING	**TXDOT**	T	9/30/07	7.42	1.93	$1,204,650
1034	1996-0697- -00	WAL	US 90	FM 359 W	FM 359 E	INSTALL ATMS	**TXDOT**	T	9/30/07	0.53	0.11	$73,000
5071	1996-0740- -XX	HAR	IH 10 W	@ FRY RD		REPLACE EXISTING 4 LN STRUCTURE TO ALLOW FOR 6	**TXDOT**	S	9/30/07	0.83	0.26	$2,860,000
5073	1996-0741- -XX	HAR	IH 10 W	@ MASON RD		REPLACE EXISTING 4 LN STRUCTURE TO ALLOW FOR 6	**TXDOT**	S	9/30/07	2.37	0.74	$3,300,000
5074	1996-0742- -	HAR	IH 10 W	@ W GREENS RD		CONSTRUCT NEW GSEP OVER	**TXDOT**	S	9/30/07	1.28	0.4	$2,200,000
5077	1996-0745- -XX	FOR	US 59 SW	@ SP 41, WILLIAMS TRACE		IMPROVEMENTS TO FRTG RD INTERSECTIONS	**TXDOT**	S	9/30/07	14	3.82	$930,000
5082	1996-0750- -	BRA	SH 288	@ CR 220B		CONSTRUCT GSEP	**TXDOT**	L	9/30/07	1.13	0.31	$6,200,000
5083	1996-0751- -XX	HAR	FM 1960	0.40 KM W OF JONES RD	0.40 KM E OF JONES RD	CONSTRUCT GSEP	**TXDOT**	S	9/30/07	3.11	0.97	$6,975,000
7033	1999-0013- -00	HAR	SH 99	AT BAYHILL HIGHLAND		CONSTRUCT GSEP	**TXDOT**	T	9/30/07	0.65	0.2	$4,000,000
7034	1999-0014- -00	HAR	SH 99	AT KINGSLAND		CONSTRUCT GSEP	**TXDOT**	T	9/30/07	0.81	0.25	$4,000,000
9909	1999-0082- -00	FOR	FM 723	AT FM 359 & FM		CONSTRUCT LEFT TURN LNS	**TXDOT**	T	9/30/07	1.3	0.36	$490,000
9910	1999-0125- -00	FOR	FM 2218	S OF FM 1640 (AT SEARS HARDWARE KEY		CONSTRUCT LEFT TURN LNS	**TXDOT**	T	9/30/07	3.83	1.05	$145,000
6099	1999-0275- -00	HAR	US 290	AT ROBERTS		CONSTRUCT INTERIM GSEP	**TXDOT**	T	8/31/03	1.13	0.35	$5,000,000
7000	1999-0276- -00	HAR	US 290	AT BECKER		CONSTRUCT INTERIM GSEP	**TXDOT**	T	9/30/07	0.6	0.19	$5,000,000
7001	1999-0277- -00	HAR	US 290	AT BAUER		CONSTRUCT INTERIM GSEP	**TXDOT**	T	9/30/07	1.12	0.35	$5,000,000
5078	T96056-XX	FOR	US 59 SW	NEAR SWEETWATER		CONSTRUCT PARK & RIDE FACILITY	**TXDOT**	S	9/30/07	5	8	$4,500,000
1151	1996-0425- -XX	LIB	LP 573	BOULEVARD ST	BOOTHE ST	CONSTRUCT CONTINUOUS LEFT TURN LANE BY REMOVING	**TXDOT-BEAUMONT DIST**	S	9/30/07	0.27	0.07	$500,000
1152	1996-0426- -XX	LIB	US 90	EAST ST	TENNESSEE ST	CONSTRUCT CONTINUOUS LEFT TURN LANE	**TXDOT-BEAUMONT DIST**	S	9/30/07	1.5	0.47	$375,000

T=2000 TIP (yrs 00-02); S=Short-range (yrs 03-07); L=Long-range (yrs 08-22); TLOC=Locally Funded; LET=Implementation in progress

Grade Separations

Calculation Methodology

Number of cars crossing the track per day (n) = (90% ADT between 6 am to 8 pm) / 840 min.
Time for gates opening & closing (T2) = 0.5 min.
AVG. waiting time for train (T1) = Train Length / (88ft/min. * train speed)
Number of vehicles stopped by train (N) = (T1+T2) * n
Time of queue dissipation = 2 sec/veh * N / 60 sec.
Existing delay per train (Dexist) = {(T1 + T2) * N/2 + T3)} / 60
Travel time savings = (Dexist) * AVG. number of train per day * (delay reduction factor)
Delay Reduction Factor = 60% G/Sep, I/C 40 %, and 30% Ramps
Annual VOC reduction travel time savings * idling emission factor * 313 * 0.002205

Intersection / Traffic Flow Improvements

Methodology

Existing Delay is based on the delay look up table (existing intersection type, major street ADT, and % minor ADT/major ADT)
Future Delay is based on the delay look up table (future intersection type, major street ADT, and % minor ADT/Major ADT)
Delay Reduction (DR) = (Existing delay - Future delay) * 1600/1800
Where 1600/1800 is the capacity increase = # passenger cars per hour per lane
Annual VOC reduction = DR * idling E.F. * 313 * 0.002205
**** More than one intersection per project, DR = (sum existing delay - sum future delay) * 1600/1800**

Bike Projects MTP 2022

METHODOLOGY

Mode Split = 0.50% (Percent who biked/walked to work from 1990 Census (journey-to-work))
Estimated Bik Mode split x Volume on a parallel arterial (from H-GAC models)/4 (average bike trip length per the facilities total mileage)
VMT Reduce((Estimated Bike/Ped Trips/1.17 Average Vehicle Occupancy) x Trip Length
where Trip Length =Estimated Average of Trip
Facility Length = From Project Form or Estimated From Map
Emission Reductions =
(VMT Reduced * Emission Factor) * (.002205)
.002205 = Grams to pounds conversion factor
Emission Factors for each year are from 24 hr runs of the Mobile model for Harris County (30mph)
representing a mix of light duty vehicles

TDM Emission Reductions : Regional Commute Alternatives/Vanpool, Telecommuting, Commuter & Transit Services Pilot Projects

1) The Vanpool Program (Regional Commute Alternatives Program)

Assumptions:

Average speed = 50 mile/hour
Vehicles Replaced by Vans are a mix of all Light Duty Vehicles proportional to the VMT mix of that area
Vans are in the category LDT2
Emission Factors are taken from Mobile5a_h runs for a 24 hour time period adjusted for commute percentages to Harris County
Vanpools run twice/day 5 days/week, 52 weeks/year - 12 Holidays
Emissions from Vanpools themselves should be subtracted from Emission Reductions

METHODOLOGY:

Number of Vanpools and Average Trip Length from METRO Regional Rideshare Program
AVO from H-GAC travel demand model mode split data.
Annual VMT Reduced = No. vanpools * AVO * Avg. trip length * two trips/day * no. days/year
VOC, CO & NOx reductions = VMT Reduced * VOC, CO & NOx EF
Annual VMT Increased = No. vanpools * Avg. trip length * two trips/day * no. days/year
VOC, CO & NOx increase = VMT Increased * VOC, CO & NOx EF
Total Pollutant Reductions = Pollutant Reductions - Pollutant Increase

2) Telecommuting

METHODOLOGY:

Vehicle Trips = Daily (HBW) person trips / AVO
AVO = 1.17, average vehicle occupancy for region
Daily VMT = Vehicle trips * 16.7 (AVG trip length)
Participation rate: 4% of workforce (based on California experience and 8/96 TTI case study of trends in Texas)
Frequency of telecommute: 36% (based on California experience and on 8/96 TTI case study)
Daily VMT reduced = Participation Rate * Frequency * Daily VMT
* Credit is taken for all anticipated telecommuting in the region, which is not accounted for in the travel demand models.
* Credit taken in year 2000 represents the ongoing program since it's implementation in FY 1998 of the 1998 TIP.

3) Commuter & Transit Services Pilot Projects

METHODOLOGY:

Average Vehicle Occupancy (AVO) = 1.12
Total trips = number of passenger trips * 1.12
Average Vehicle Occupancy (AVO) = 1.12
VMT reduced = total trips * average trip length. Average trip length was provided by the service provider. However, for NHA 1/2 of the round trip is assumed.
Emission reduced = VMT reduced * emission factor (composite non-freeway) for all vehicles other than heavy-duty

Van emissions = vehicle total miles * emission factor used for vans
Total emissions reduced = (emissions reduced - vehicle emissions) * 0.002205 * 255 and 365 days for Bay Area
The Emission Factor used is for vans or smaller vehicles.
2% increase is assummed for ridership increase.

Park and Ride Emission Reductions

METHODOLOGY:

% Utilization = Fraction of total spaces occupied. Estimates provided by METRO.
VMT = daily vehicle trips x 12.73 ATL (in miles)
daily vehicle trips = (one-way person trips) x 2
ATL = Average Trip Length for work trips,
converted from 21.8 minutes to 12.73 miles
ATL (hours) x average systemwide sp = ATL (miles)
(21.8 minutes / 60 minutes) x 35.04 mph = 12.73 miles
VOC REDUCTION = VOC RATE x VMT

CONVERSION FACTORS: pounds per day = grams per day x 0.00205

* Note: These park-and-ride lots were not implicitly included in the H-GAC travel demand process.

Arterial Traffic Management System (ATMS)

Methodology:

DRF = 10%
Annual emissions reduced = delay reduction * idling emission factor * 313 * 0.002205
Annualization factor = 0.244 (for five years life)
** Multiple locations

RCTSS

Methodology

Peak hour volume: (AM=8.5% of ADT + PM=9.25% of ADT)
Estimation of idling time reduction:
Free flow speed with no delay = 50 mph
Peak hour speed = 30 mph
Delay per vehicle = ((1/30) - (1/50)) = 0.0133
If the average speed is increased to 35 mph during the peak period
Delay per vehicle = ((1/35) - (1/50)) = 0.0086
Saving in delay for the project length = 0.0133 - 0.0086 = 0.0047 * project length
Assuming 60% of the delay is due to incidents and 67% of incidents is the idling time,
then reduction in idling time = saving in delay for the project length * 60% * 67% * peak hour volume
Emissions reduced due to idling = reduction in idling time * idling emission factor * 313 * 0.002205

Emission Reduction For Speed Improvement

Emissions for 1st hour of AM and PM peak period = (peak period volume * project length * EF @ 30 mph) - (peak period volume * project length * EF @ 35 mph)
Emissions for 2nd hour of Am and PM peak period = (peak period volume * project length * EF @ 40 mph) - (peak period volume * project length * EF @ 45 mph)
Annual emissions reduction for speed improvement = (emissions reductions in 1st hour + emissions reductions 2nd hour) * 313 * 0.002205
Total emissions reduction = idling emissions reductions + speed improvement emissions reduction

* Analysis was done for 20 intersections to obtain an average; this average was used for all intersections

Signalization

METHODOLOGY:

Same as ATMS.

Port of Houston

Sources:

2000 VMT used is the same as the 1999 VMT (Dec, 1997 Conformity) for Trucks as well as Other Traffic and future years grown
Emission Factors for VOC & Nox for HDDV & Other Traffic (H-GAC)
Emission Factors For VOC & Nox for Locomotives (USEPA, Air & Radiation Report, EPA420-F-97-051 dated December, 1997)

Methodology

2000 VMT used is the same as the 1999 VMT (Dec 1997 Conformity) for Trucks as well as Other Traffic and future years grown
Emissions Reduced Due to Truck Traffic = VMT reduced * EF for HDDV at 48 mph speed
Emissions Reduced due to improved speed = VMT reduced * EF difference for 38 to 40 mph speed
Emissions due to train traffic = EF for Locomotives * Fuel used per train(gal/train) * 1.005(increase of .5%)
Net Emissions Reduction = Emissions Reduced by Truck Traffic + Emissions Reduced by Other Traffic - Emissions due to Train Traffic

* Note: Please see Radian methodology on port projects benefits derivation.

BRAZOS TRANSIT

METHODOLOGY:

Daily VMT reduced = 35 passengers per trips * 4 runs (2 AM & 2 PM peak period) * 30 miles (average trip length) * 6 buses
Daily emissions reduced = Daily VMT reduced * VOC emission factor @35 mph
Bus daily mileage = 30 miles (average trip length) * 8 runs (4 AM & 4 PM peak periods) * 6 buses
Daily bus emissions = bus daily mileage * VOC emission factor for HDDV @ 45mph (assume HOV speed)
Total annual emissions reduced = (daily emissions reduced - daily bus emissions) * 0.002205 * 260

CTMS Projects

METHODOLOGY:

Peak hour volume: (AM=8.5% of ADT + PM=9.25% of ADT)
Estimation of idling time reduction:
Free flow speed with no delay = 50 mph
Peak hour speed = 30 mph
Delay per vehicle = ((1/30) - (1/50)) = 0.0133
If the average speed is increased to 35 mph during the peak period
Delay per vehicle = ((1/35) - (1/50)) = 0.0086
Saving in delay for the project length = 0.0133 - 0.0086 = 0.0047 * project length
Assuming 60% of the delay is due to incidents and 67% of incidents is the idling time,
then reduction in idling time = saving in delay for the project length * 60% * 67% * peak hour volume
Emissions reduced due to idling = reduction in idling time * idling emission factor * 313 * 0.002205

Emission Reduction For Speed Improvement

Emissions for 1st hour of AM and PM peak period = (peak period volume * project length * EF @ 30 mph) - (peak period volume * project length * EF @ 35 mph)
Emissions for 2nd hour of Am and PM peak period = (peak period volume * project length * EF @ 40 mph) - (peak period volume * project length * EF @ 45 mph)
Emission Factors represent the vehicle mix on urban freeways
Annual emissions reduction for speed improvement = (emissions reductions in 1st hour + emissions reductions 2nd hour) * 313 * 0.002205
Total emissions reduction = idling emissions reductions + speed improvement emissions reduction

PROJ ID	PROJ NUM	CO	STREET	FROM LOCATION	TO LOCATION	PROJECT DESCRIPTION	PROJ TYPE	LEAD AGENCY	PROJ STATUS	ESTIMATE COMPLETE	COMM YR	TOTAL VOC REDUCED (lbs/day)	TOTAL Nox REDUCED (lbs/day)	TOTAL COST	COMMENTS	1996-1999 TCM PROJS
5053	1996-0722--00	HAR	GOOSE CREEK TRAIL	W TEXAS AVE	GARTH RD	CONST HIKE/BIKE TRAIL ALONG GOOSE CREEK (PHASE 4)	BIKE/PED	CITY OF BAYTOWN	T	8/1/04	2007	0.19210	0.3148	$1,361,919		
3069	HO.HR.0154B	HAR	GOOSE CREEK TRL	ARIZONA ST	W TEXAS AVE	CONST HIKE & BIKE TRAIL (PHASE 2)	BIKE/PED	CITY OF BAYTOWN	T LET	5/1/02	2007	0.13290	0.2178	$1,218,614		
9954	HO.HR.0154C	HAR	VA GOOSE CREEK TRAIL FROM S OF W TEXAS	W TEXAS AVE		CONSTRUCT HIKE/BIKE TRAIL SUPPLEMENTAL FUNDING TO ENHANCEMENT PROJECT (PHASE 2)	BIKE/PED	CITY OF BAYTOWN	T LET	5/1/02	2007	0.13290	0.2178	$806,250		
9987	HO.HR.0181A	HAR	CBD ACCESS ON-STREET	NORTH SEGMENT		CBD ACCESS ON-STREET BIKEWAY NETWORK (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	LET	6/1/01	2000	1.37050	2.246	$2,076,965		
9988	HO.HR.0181B	HAR	CBD ACCESS ON-STREET BIKEWAYS	SOUTH SEGMENT - PH 1		CBD ACCESS ON-STREET BIKEWAY NETWORK (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	LET	12/1/00	2000	2.34150	3.8373	$1,282,474		
9989	HO.HR.0181C	HAR	CBD ACCESS ON-STREET BIKEWAYS	SOUTH SEGMENT - PH 2		CBD ACCESS ON-STREET BIKEWAY NETWORK (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	T	3/1/02	2007	0.22080	0.3618	$156,600		
3071	HO.HR.0182A	HAR	TMC/GREENWAY PLAZA/GALLERIA ON-ST BIKE			MED CTR/GREENWAY PLAZA/GALLERIA ACCESS ON-STREET BIKEWAY NETWORK-EAST SEG PH 1 (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	LET	9/1/01	2000	2.95810	4.8479	$1,277,400		
7003	HO.HR.0182B	HAR	TMC/GREENWAY PLAZA/GALLERIA ON-ST BIKE			TMC/GREENWAY PLAZA/GALLERIA ACCESS ON-STREET BIKEWAY NETWORK -NORTH SEGMENT PH 1 (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	LET	12/1/00	2000	0.72430	1.1871	$440,000		
7004	HO.HR.0182C	HAR	TMC/GREENWAY PLAZA/GALLERIA ON-ST BIKE			TMC/GREENWAY PLAZA/GALLERIA ACCESS ON-STREET BIKEWAY NETWORK -WEST SEGMENT PH 1 (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	LET	10/1/01	2007	4.12160	6.7547	$1,734,700		
7005	HO.HR.0182D	HAR	TMC/GREENWAY PLAZA/GALLERIA ON-ST BIKE			TMC/GREENWAY PLAZA/GALLERIA ACCESS ON-STREET BIKEWAY NETWORK-PH 2 (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	T	3/1/02	2007	1.26760	2.0774	$1,661,900		
3074	HO.HR.0189	HAR	W WHITE OAK BAYOU TRAIL	11TH ST	S OF PINEMONT	CONSTRUCT W WHITE OAK BAYOU TRAIL (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	LET	9/1/00	2000	0.25560	0.4188	$2,602,000		
3075	HO.HR.0192A	HAR	HARRISBURG/SUNSET RAILS TO TRAILS	CHENEVERT	75TH STREET AND BUFFALO BAYOU	HARRISBURG/SUNSET RAILS TO TRAILS-PH 1 (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	LET	6/1/00	2000	0.26120	0.428	$2,075,000		

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7006	HO.HR.0192B	HAR	HARRISBURG/SUNSET RAILS TO TRAILS			HARRISBURG/SUNSET RAILS TO TRAILS-PH 2 (TCM SIP COMMITMENT)	BIKE/PED	CITY OF HOUSTON/TXDOT	T	3/1/02	2007	0.10190	0.167	$952,000		
2934	HOU.HR.317	HAR	NORTH CHANNEL HIKE & BIKE TRL	WOODFOREST BLVD (SOUTH)	WALLISVILLE RD (NORTH)	CONST HIKE & BIKE TRL (HARRIS CO, PCT2)	BIKE/PED	HARRIS COUNTY	T	9/30/07	2007	0.06430	0.1054	$787,415		
												14.15	23.18			
2445	1996-0432-A-00	HAR	BARBOURS CUT QUEUE LNS			CONSTRUCT QUE LANES ALONG GEORGE ALTWATER RD (TRAFFC	INTMDL	PORT OF HOUSTON AUTHORITY	T	9/30/03	2007	6.68200	31.138	$2,750,000		
7104	1996-0432-B-00	HAR	BARBOURS CUT TERMINAL			CONSTRUCT ADDITIONAL RAIL TO BARBOURS CUT TERMINAL	INTMDL	PORT OF HOUSTON AUTHORITY	T	9/30/03	2007	6.68200	31.138	$850,000		
2982	1996-0433-A-00	HAR	TRANSFER STA @ INDSTRL			CONSTRUCT 8900 FT OF RAILROAD TRACK (PH 1)	INTMDL	PORT OF HOUSTON AUTHORITY	T	8/31/03	2007	6.68200	31.138	$4,625,000		
9534	1995-0220-B-00	HAR	DEER PARK JUNCTION TERMINAL	AT STRANG YARD		CONSTRUCT PORT OF HOUSTON LEAD TRACK - SEGMENT 3 AT STRANG YARD	INTMDL	PORT OF HOUSTON AUTHORITY	LET	8/31/01	2007	6.68200	31.38	$14,882,830		
												26.73	124.79			
1007	1993-0523-B-00	HAR	IH 10 W	STUDEMONT	SAN JACINTO	INSTALL CTMS	ITS	TXDOT	T	9/30/07	2007	32.60000	8.5	$1,255,000		
1027	1994-0264--00	HAR	US 59 SW	W BELLFORT	FOR C/L	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	6.60000	1.72	$318,000		
1008	1994-0266-A-00	HAR	IH 10	MEADOW ST	SP 330	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	8/31/02	2007	95.17000	24.81	$6,177,062		
9527	1994-0266-A-	HAR	IH 10 E	SAN	MEADOW	INSTALL CTMS (TCM SIP	ITS	TXDOT	T	9/30/07	2007	17.97000	4.68	$600,000		
1026	1994-0267--00	HAR	SP 330	IH 10	LP 201 (SH 146)	INSTALL CTMS	ITS	TXDOT	T	9/30/07	2007	69.25000	18.05	$3,483,000		
1012	1995-0163--00	GAL	IH 45 S	61ST ST	S OF SH 6	CTMS (TV CIRCUIT & VEH DETECTION SYS)	ITS	TXDOT	LET	8/31/02	2000	19.88000	5.09	$3,856,000		
1028	1995-0164--98	HAR	US 59 NE	0.28 MI N OF	IH 610	INSTALL CTMS	ITS	TXDOT	LET	8/31/04	2000	87.23000	22.74	$1,082,654		
9533	1995-0164-A-00	HAR	US 59 SW	IH 610	0.019 MI N OF BELL ST	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	144.75000	37.73	$2,780,000		
1013	1995-0165--00	MON	IH 45 N	N OF CRIGHTON RD	LP 336 N	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	17.22000	4.41	$2,610,000		
1029	1995-0169--00	HAR	US 59 NE	FM 1960	MON C/L	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	21.66000	5.65	$1,783,000		
1014	1995-0170--00	HAR	IH 45 N	RANKIN RD	CYPRESSWOOD	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	8/31/01	2007	95.67000	24.94	$3,596,000		
1825	1995-0170-A-00	HAR	IH 45 N	CYPRESSWOOD	MON C/L	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	33.76000	8.8	$2,409,000		

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1030	1995-0171-00	HAR	US 59 SW	BELL ST	S SHEPHERD	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	50.23000	13.09	$2,162,000		
1015	1995-0175-00	MON	IH 45 N	HAR C/L	TAMINA RD	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	77.79000	19.9	$2,889,000		
9536	1995-0175-A-00	MON	IH 45 N	TAMINA RD	0.966 KM N OF CRIGHTON RD	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	30.30000	7.75	$3,956,000		
1031	1995-0176-00	FOR	US 59 SW	0.4235 MI W OF S KIRKWOOD DR	SH 6	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	29.74000	7.61	$2,800,000		
1032	1995-0178-98	HAR	US 59 NE	GREENS BAYOU	0.28 MI N OF SAUNDERS	INSTALL CTMS	ITS	TXDOT	LET	8/31/01	2000	54.18000	14.12	$3,027,731		
9532	1995-0178-A-98	HAR	US 59 NE	0.136 MI S OF BF	GREENS BAYOU	INSTALL CTMS	ITS	TXDOT	LET	8/31/01	2000	43.63000	11.37	$2,172,654		
1019	1995-0179-00	HAR	SH 249	WESTLOCK	BW 8	INSTALL CTMS (TCM SIP COMMITMENT)	ITS	TXDOT	T	9/30/07	2007	45.46000	11.85	$4,540,000		
1016	1995-0180-	GAL	IH 45 S	S OF SH 6	HAR C/L	INSTALL CTMS	ITS	TXDOT	LET	8/31/02	2007	31.60000	8.08	$10,345,000		
3010	1996-0471-00	HAR	SH 225	SH 134	STRANG RD	INSTALL CTMS	ITS	TXDOT	LET	8/31/02	2007	3.88000	1.01	$2,270,000		
1103	1996-0650-00	HAR	SH 146	MCCABE RD	TYLER ST	INSTALL CTMS - INCL SURVELLANCE SYS, COMMUNICATN SYS, SATELLITE COMPUTER FAC. & MONITORING	ITS	TXDOT	T	9/30/07	2007	7.42000	1.93	$1,204,650		
	930521						ITS		LET			83.59199	21.38488			Y
	930569						ITS		LET			38.49895	10.03627			Y
	930527						ITS		LET			11.90865	3.10446			Y
	930567						ITS		LET			14.90007	3.88429			Y
	930531						ITS		LET			166.69931	42.64577			Y
	0						ITS		LET			360.46451	93.96925			Y
	950167						ITS		LET			30.50514	7.95237			Y
	950177						ITS		LET			50.37962	13.13343			Y
	930602						ITS		LET			10.07637	2.62680			Y
	930600						ITS		LET			41.96287	10.93927			Y
	930578						ITS		LET			74.11972	19.32222			Y
	930579						ITS		LET			42.81939	10.95425			Y
	930580						ITS		LET			121.30827	31.62377			Y
	930599						ITS		LET			57.77833	15.06219			Y
	930601						ITS		LET			48.79352	12.48258			Y
	930593						ITS		LET			104.86196	27.33639			Y
	940268						ITS		LET			57.07256	14.60056			Y
	940266						ITS		LET			0.00000	8.97088		Credit for Nox reductionss from 96-99 commitmnts	Y
	950175						ITS		LET			0.00000	11.04505		Credit for Nox reductionss from 96-99 commitmnts	Y
	950165						ITS		LET			0.00000	3.87840		Credit for Nox reductionss from 96-99 commitmnts	Y
	950170						ITS		LET			0.00000	6.51828		Credit for Nox reductionss from 96-99 commitmnts	Y

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	950179						ITS		LET			0.00000	11.73457		Credit for Nox reductionss from 96-99 commitmnts	Y
	950164						ITS		LET			0.00000	8.71299		Credit for Nox reductionss from 96-99 commitmnts	Y
	950171						ITS		LET			0.00000	7.61254		Credit for Nox reductionss from 96-99 commitmnts	Y
	950169						ITS		LET			0.00000	3.06169		Credit for Nox reductionss from 96-99 commitmnts	Y
	950176						ITS		LET			0.00000	4.01233		Credit for Nox reductionss from 96-99 commitmnts	Y
	950178						ITS		LET			0.00000	11.41442		Credit for Nox reductionss from 96-99 commitmnts	Y
	940264						ITS		LET			0.00000	4.10562		Credit for Nox reductionss from 96-99 commitmnts	Y
												2,331.73	685.96			
1034	1996-0697--00	WAL	US 90	FM 359 W	FM 359 E	INSTALL ATMS	ITS-ATMS	TXDOT	T	9/30/07	2007	0.53000	0.11	$73,000		
1023	1994-0386--00	GAL	SH 6	FM 2004	FM 519	INSTALL ATMS	ITS-ATMS	TXDOT	LET	8/31/01	2007	0.52000	0.11	$183,000		
1011	1994-0692--00	GAL	IH 45 S	W OF 59TH ST	61ST ST	INSTALL ATMS	ITS-ATMS	TXDOT	T		2007	0.58000	0.14	$65,000		
9846	1994-0254-A-98	HAR	FM 529	HUFFMEISTER RD	BARKER-CYPRESS RD	INSTALL ATMS	ITS-ATMS	TXDOT	LET	8/31/01	2000	0.85000	0.2	$393,513		
1020	1994-0271--00	BRA	SH 35	14TH ST	SH 36	INSTALL ATMS (TCM SIP COMMITMENT)	ITS-ATMS	TXDOT	T	9/30/07	2007	0.34000	0.07	$178,000		
1071	1994-0244-B-98	FOR	US 59 SW	W OF S KIRKWOOD	RAMPS AT SP 41/SUGAR CRK BLVD	UPGRADE FIXED TIME TO ACTUATED SIGNALS	TSM	TXDOT	LET	8/31/03	2000	0.00338	0.0000001	$40,000		
1072	1994-0244-C-98	FOR	US 59 SW	RAMPS AT SPUR 41/SUGAR	SH 6	UPGRADE FIXED TIME TO ACTUATED SIGNALS	TSM	TXDOT	LET	8/31/03	2000	0.00500	0.0000001	$150,000		
	930584						ITS-ATMS					1.65324	0.32096			Y
	930564						ITS-ATMS					0.83769	0.16144			Y
	930581						ITS-ATMS					0.97997	0.18815			Y
	930546						ITS-ATMS					0.52028	0.10010			Y
	930547						ITS-ATMS					1.03924	0.20175			Y
	930585						ITS-ATMS					0.34920	0.06637			Y
	930539						ITS-ATMS					0.90562	0.17381			Y
	930577						ITS-ATMS					0.90076	0.17229			Y

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	930573						ITS-ATMS					0.38247	0.07158			Y
	930574						ITS-ATMS					0.68739	0.13170			Y
	930536						ITS-ATMS					0.31975	0.06030			Y
	930519						ITS-ATMS					0.98814	0.19081			Y
	930538						ITS-ATMS					0.58287	0.11319			Y
	930566						ITS-ATMS					0.27035	0.05159			Y
	930559						ITS-ATMS					1.16420	0.22034			Y
	930558						ITS-ATMS					3.78305	0.78191			Y
	930520						ITS-ATMS					3.52045	0.68108			Y
	930570						ITS-ATMS					0.47224	0.09130			Y
	930571						ITS-ATMS					0.77743	0.15011			Y
	930572						ITS-ATMS					1.05238	0.20349			Y
	940286						ITS-ATMS					1.10124	0.20860			Y
	940276						ITS-ATMS					2.04379	0.39518			Y
	930576						ITS-ATMS					0.69169	0.13237			Y
	930575						ITS-ATMS					0.91851	0.17789			Y
	930603						ITS-ATMS					1.30918	0.25163			Y
	930605						ITS-ATMS					1.10309	0.21133			Y
	930604						ITS-ATMS					1.45225	0.28088			Y
	940285						ITS-ATMS					0.95748	0.18575			Y
	940278						ITS-ATMS					0.77110	0.14908			Y
	930582						ITS-ATMS					2.42101	0.45728			Y
	930583						ITS-ATMS					1.87130	0.36491			Y
	940279						ITS-ATMS					2.38108	0.46021			Y
	930606						ITS-ATMS					2.72928	0.55686			Y
	930607						ITS-ATMS					1.85710	0.36196			Y
	930608						ITS-ATMS					0.66650	0.12983			Y
	930609						ITS-ATMS					2.12947	0.42156			Y
	930610						ITS-ATMS					2.19739	0.42578			Y

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	940255						ITS-ATMS					1.83109	0.36054			Y
	930595						ITS-ATMS					1.08465	0.21083			Y
	940277						ITS-ATMS					1.20948	0.23255			Y
	930597						ITS-ATMS					1.51056	0.29482			Y
	930596						ITS-ATMS					1.06155	0.20466			Y
	930598						ITS-ATMS					2.10115	0.41583			Y
	940254						ITS-ATMS					1.15048	0.22291			Y
	930592						ITS-ATMS					1.04539	0.20098			Y
	930591						ITS-ATMS					1.30918	0.25163			Y
	930594						ITS-ATMS					0.81660	0.15799			Y
	940270						ITS-ATMS					0.30101	0.05796			Y
	930589						ITS-ATMS					0.38367	0.07436			Y
	940271						ITS-ATMS					0.00000	0.05859			Y
	930561						ITS-ATMS					0.98962	0.19192			Y
	930563						ITS-ATMS					0.40776	0.07896			Y
	930560						ITS-ATMS					0.67545	0.13037			Y
	930565						ITS-ATMS					0.18105	0.03433			Y
	930562						ITS-ATMS					0.24561	0.04667			Y
	940272						ITS-ATMS					0.38856	0.07538			Y
	940273						ITS-ATMS					0.41376	0.07977			Y
	930557						ITS-ATMS					0.54680	0.10410			Y
	940287						ITS-ATMS					0.98962	0.19192			Y
	940283						ITS-ATMS					0.34526	0.06683			Y
	940284						ITS-ATMS					0.24775	0.04778			Y
	940241						ITS-ATMS					0.58227	0.11381			Y
	930590						ITS-ATMS					1.78053	0.34857			Y
	940275						ITS-ATMS					1.20492	0.22908			Y
	940274						ITS-ATMS					1.50961	0.29163			Y
	940253						ITS-SIGNL					0.84605	0.23111			Y

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	940250						ITS-SIGNL					0.90513	0.24725			Y
	940238						ITS-SIGNL					0.94201	0.25733			Y
	940239						ITS-SIGNL					0.83480	0.22804			Y
	940240						ITS-SIGNL					1.42633	0.38963			Y
	940247						ITS-SIGNL					0.36721	0.10031			Y
	940248						ITS-SIGNL					0.66505	0.18167			Y
	940249						ITS-SIGNL					1.08396	0.29610			Y
	940246						ITS-SIGNL					0.56275	0.15373			Y
	940245						ITS-SIGNL					3.19525	0.87284			Y
	940242						ITS-SIGNL					0.48408	0.13223			Y
	940243						ITS-SIGNL					1.13618	0.31037			Y
	940244A						ITS-SIGNL					0.00000	0.28235		Credit for Nox reductionss from 96-99 commitmnts	Y
	940251						ITS-SIGNL					0.97479	0.26628			Y
	940244C						ITS-SIGNL					0.00000	1.42117		Credit for Nox reductionss from 96-99 commitmnts	Y
	940244B						ITS-SIGNL					0.00000	0.66780		Credit for Nox reductionss from 96-99 commitmnts	Y
	940241						ITS-SIGNL					2.13717	0.58381			Y
												90.49	21.33			
9980	199-0129-	-00	HAR	VA		CBD TO DOME HIGH CAPACITY TRANSITWAY PROJECT	TRANS	METRO	TLOC	9/30/07	2007	1215.00	448.80	$300,000,000		
						TIDWELL TRANSIT CENTER						0.00000	0.40		Credit for Nox reductionss from 96-99 commitmnts	Y
						MESA TRANSIT CENTER						0.00000	0.60		Credit for Nox reductionss from 96-99 commitmnts	Y
						HILLCROFT TRANSIT CENTER						0.00000	8.20		Credit for Nox reductionss from 96-99 commitmnts	Y
						W BELLFORT PARK & RIDE						0.00000	20.40		Credit for Nox reductionss from 96-99 commitmnts	Y
						KINGWOOD PARK & RIDE MODIFICATION						0.00000	0.20		Credit for Nox reductionss from 96-99 commitmnts	Y

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						NORTHWEST PARK & RIDE - 2ND EXPANSION						0.00000	21.40		Credit for Nox reductionss from 96-99 commitmnts	Y
						ADDICKS PARK & RIDE - 2ND EXPANSION PH 1						0.00000	18.20		Credit for Nox reductionss from 96-99 commitmnts	Y
						BAY AREA BLVD PARK & POOL						0.00000	10.00		Credit for Nox reductionss from 96-99 commitmnts	Y
		HAR				TIDWELL TRANSIT CENTER	TR-P&R	METRO		9/30/07	2007	0.69759	1.15828		Analysis conducted by Metro (L. Mifsud)	
		HAR				MESA TRANSIT CENTER	TR-P&R	METRO		9/30/07	2007	0.64592	1.07248		Analysis conducted by Metro (L. Mifsud)	
		HAR				HILLCROFT TRANSIT CENTER	TR-P&R	METRO		9/30/07	2007	4.64135	7.30904		Analysis conducted by Metro (L. Mifsud)	
		HAR				MISSION BEND PARK & RIDE	TR-P&R	METRO		9/30/07	2007	0.55791	0.45117		Analysis conducted by Metro (L. Mifsud)	
		HAR				W BELLFORT PARK & RIDE	TR-P&R	METRO		9/30/07	2007	19.24576	21.74519		Analysis conducted by Metro (L. Mifsud)	
		HAR				KINGWOOD PARK & RIDE MODIFICATION	TR-P&R	METRO		9/30/07	2007	6.12189	10.16475		Analysis conducted by Metro (L. Mifsud)	
		HAR				NORTHWEST PARK & RIDE - 2ND EXPANSION	TR-P&R	METRO		9/30/07	2007	46.82202	77.74310		Analysis conducted by Metro (L. Mifsud)	
		HAR				ADDICKS PARK & RIDE - 2ND EXPANSION PH 1	TR-P&R	METRO		9/30/07	2007	45.89261	76.19991		Analysis conducted by Metro (L. Mifsud)	
		HAR				BAY AREA BLVD PARK & POOL	TR-P&R	METRO		9/30/07	2007	5.24020	7.56450		Analysis conducted by Metro (L. Mifsud)	
												129.87	282.81			
3006	1996-0467--98	MON	IH 45 N	@ FM 1097		IMPROVE INTERSECTION & WIDEN BRIDGE	SOV-TSM	TXDOT	LET	8/31/00	2007	2.79000	0.76	$2,000,000		
6070	1999-0263--00	HAR	FAIRMONT PKWY	AT SP RR		CONSTRUCT GSEP	TSM	HARRIS COUNTY	T	9/30/07	2007	0.77000	0.24	$5,000,000		
1062	1994-0378--XX	BRA	SH 35	@ MUSTANG RD & @ FM 1459		ADD LTLS	TSM	TXDOT	~~S~~	5/1/02	2007	3.33000	0.91	$140,000		
206	1994-0379--00	HAR	US 290	@ MASON RD		CONSTRUCT GSEP	TSM	TXDOT	LET	9/30/07	2007	1.09000	0.34	$8,500,000		
1144	1996-0255--00	HAR	BU 90-U	IH 610 E	BW 8 E	ADD CLT LN W/ C&G	TSM	TXDOT	T	9/30/07	2007	0.24000	0.08	$2,500,000		
2971	1996-0258--XX	HAR	BW 8 E	PASADENA BLVD	RED BLUFF RD	IMPROVE INTERSECTION PROFILE - TURNING RADIUSES & LEFT TURN	TSM	TXDOT	T	9/30/07	2007	0.87000	0.24	$1,000,000		
2996	1996-0457--98	GAL	FM 1764	@		CONSTRUCT RIGHT TRN LANES @ INTERSECTION	TSM	TXDOT	~~S~~	2/1/01	2007	1.30000	0.36	$121,719		
2999	1996-0460--98	FOR	FM 2234	@ FM 521		CONSTRUCT ADDT'L TRN	TSM	TXDOT	LET	8/31/00	2000	4.12000	1.13	$1,200,000		
3000	1996-0461--98	FOR	FM 359	@ US 90A		CONSTRUCT ADDT'L TURN LANES @	TSM	TXDOT	LET	8/31/99	2000	4.12000	1.13	$352,748		
3007	1996-0468--98	HAR	IH 610	@ N SHEPHERD, N DURHAM AND FLA		CONSTRUCT U-TURNS	TSM	TXDOT	LET	8/31/00	2000	1.94000	0.61	$680,000		

PROJ ID	PROJ NUM	CO	STREET	FROM LOCATION	TO LOCATION	PROJECT DESCRIPTION	PROJ TYPE	LEAD AGENCY	PROJ STATUS	ESTIMATE COMPLETE	COMM YR	TOTAL VOC REDUCED (lbs/day)	TOTAL Nox REDUCED (lbs/day)	TOTAL COST	COMMENTS	1996-1999 TCM PROJS
3009	1996-0470- -98	GAL	SH 146	@ EDGEWATER & LP 197 N		CONSTRUCT RIGHT TURN LANES	TSM	TXDOT	LET	8/31/99	2000	0.81000	0.22	$243,671		
2993	1996-0485- -00	HAR	BW 8	AT WESTHEIMER		ADD RIGHT TRN LNS AT INTERSECTIONS NBOUND	TSM	TXDOT	T	9/30/07	2007	1.46000	0.46	$500,000		
2995	1996-0487- -98	GAL	FM 1764	@ SH 146		CONSTRUCT RIGHT TURN LN	TSM	TXDOT	LET	8/31/00	2000	0.56000	0.15	$78,951		
9909	1999-0082- -00	FOR	FM 723	AT FM 359 & FM 1093		CONSTRUCT LEFT TURN LNS	TSM	TXDOT	T	9/30/07	2007	1.30000	0.36	$490,000		
9910	1999-0125- -00	FOR	FM 2218	S OF FM 1640 (AT SEARS HARDWARE KEY MAP		CONSTRUCT LEFT TURN LNS	TSM	TXDOT	T	9/30/07	2007	3.83000	1.05	$145,000		
6099	1999-0275- -00	HAR	US 290	AT ROBERTS		CONSTRUCT INTERIM GSEP	TSM	TXDOT	T	8/31/03	2007	1.13000	0.35	$5,000,000		
7000	1999-0276- -	HAR	US 290	AT		CONSTRUCT INTERIM	TSM	TXDOT	T	9/30/07	2007	0.60000	0.19	$5,000,000		
7001	1999-0277- -	HAR	US 290	AT BAUER		CONSTRUCT INTERIM	TSM	TXDOT	T	9/30/07	2007	1.12000	0.35	$5,000,000		
5077	1996-0745- -XX (0027-12-0523-10-024	FOR	US 59 SW	@ SP 41, WILLIAMS		IMPROVEMENTS TO FRTG RD	TSM	TXDOT	~~S LET~~	9/30/07	2007	14.00000	3.82	$930,000		
		MON	FM 1488	NEW MAGNOLIA HS		WIDEN PVMT FOR L & R TURN LANES	TSM	TXDOT		4/1/01	2007	0.500	0.142	$300,000		
	1415-02-031	FOR	FM1464	AT WEST OAKS		CONSTRUCT L TURN LANE & SIGNALTXDOT	TSM	TXDOT		6/1/01	2007	1.260	0.185	$282,000		
	0179-01-043	BRA	SH35	SH288	WALKER ST.	CONTINOUS LEFT TURN LN CLTL	TSM	TXDOT		1/1/04	2007	0.510	0.147	$160,000		
	0188-02-034	FOR	SH36	AT FRITZELLA		ADD RIGHT TURN LANE	TSM	TXDOT		6/1/01	2007	0.740	0.200	$127,000		
	0116-03-046	MON	SH75	LEAGUE LINE RD		ADD LEFT TURN LANE & SIGNAL	TSM	TXDOT		2/1/04	2007	0.670	0.093	$220,000		
												49.06	13.52			

Total 2007 Emission Reductions by Type of TCM

TCM Type	VOC Benefits (lbs/day)	NOx Benefits (lbs/day)
Computerized Traffic Mgmt. System	2,331.73	685.96
Arterial Traffic Mgmt. System/Signals	90.49	21.33
Bicycle/Pedestrian Projects	14.15	23.18
Port Projects	26.73	124.79
High Capacity Transitway	1,215.00	448.80
Park & Ride Lots	129.87	282.81
Intersection Improvements	49.07	13.52
Total Emission Reductions:	**3,857.03**	**1,600.39**